

P/N: MAN-EV001TC



HIGH PRESSURE/HIGH VOLUME COOLANT SYSTEMS

**EV13, EVHP with TWIDO PLC and OPTIONAL
THINC[®] INTERFACE**

VARIABLE VOLUME MODELS

HIGH PRESSURE / HIGH VOLUME COOLANT DELIVERY SYSTEM

**THESE MODELS ARE PROTECTED UNDER UNITED STATES PATENT
NUMBER 5,951,216**



INSTALLATION, OPERATION and SERVICE MANUAL

**ChipBLASTER, Inc.
13605 South Mosiertown Road
Meadville, PA 16335
USA**

www.chipblaster.com

Telephone 814-724-6278

Fax 814-724-6287

For your records please list serial number from nameplate _____

REV C

[illegible]

GENERAL:

**This manual covers the following ChipBLASTER models:
EV13 and EVHP with THINC[®] Control**

**For the model number of your unit refer to the data nameplate located on
the enclosure door.**

UNIT MODEL NUMBER

UNIT SERIAL NUMBER

DATA NAME PLATE

ChipBLASTER

www. chipblaster.com
13605 SOUTH MOSIERTOWN ROAD
MEADVILLE, PA 16335 USA
TELEPHONE: 814-724-6278
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MODEL _____ SERIAL No. _____

SUPPLY: VOLTAGE/PHASE/FREQUENCY _____ VAC _____ PH. _____ HZ

FULL LOAD CURRENT _____ AMPS LARGEST LOAD _____ AMPS

AMP RATING OF DISCONNECT DEVICE _____ AMPS

DATE OF MFG. ____ - ____ - ____

HIGH PRESSURE PUMP LUBRICANT: Mobil 1 15W-50

**FOR THE NEAREST MOBIL LUBRICANT SUPPLIER OR
FOR TECHNICAL INFORMATION, CALL 1-800-662-4525.**

1.0. GENERAL WARNINGS:

Thank you for purchasing a ChipBLASTER high-pressure coolant system.

**For reliable, safe and long term operation of your ChipBLASTER:
Machine must be installed and connected to electric service per the installation
portion of this manual.**



All persons who will be operating and maintaining this machine must read and understand this manual.



**DO NOT AT ANY TIME USE FLAMMABLE OR EXPLOSIVE FLUIDS IN OR
NEAR MACHINE.**



**THE ADJUSTABLE FREQUENCY DRIVE HAS THE POTENTIAL TO HOLD A
LETHAL CHARGE FOR APPROXIMATELY 10 MINUTES AFTER POWER IS
REMOVED FROM THE DRIVE. REFER TO THE DRIVE MANUAL FOR
DETAILS.**



**DO NOT STAND ON MOTORS, SUPPORTS, or JUNCTION BOXES WHILE
WORKING ON THE ChipBLASTER.**

REFER TO SECTION 4.1. FOR EXPLANATION OF MARKINGS

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3.0. EV13, EVHP SPECIFICATIONS:

		EV13		EVHP	
		230 VAC	460 VAC	230 VAC	460 VAC
MAXIMUM PRESSURE					
	PSIG	1900	1900	3000	3000
	BAR	131	131	206.8	206.8
MAX. COOLANT VOLUME					
	GALLONS / MIN.	13	13	13	13
	LITERS/MIN.	49.2	49.2	49.2	49.2
COOLANT TANK VOLUME					
	GALLONS	48	48	48	48
	LITERS	181.6	181.6	181.6	181.6
DIMENSIONS DxLxH					
	INCHES	35x55x48	35x55x48	35x55x48	35x55x48
	MILLIMETERS	889x1397x1219	889x1397x1219	889x1397x1219	889x1397x1219
AREA REQUIRED DxWxH					
	FEET	7.0x9.6x7.0	7.0x9.6x7.0	7.0x9.6x7.0	7.0x9.6x7.0
	METERS	2.1x2.9x2.1	2.1x2.9x2.1	2.1x2.9x2.1	2.1x2.9x2.1
POWER KVA					
	WITHOUT MISTBLASTER	14.5	14.5	14.5	14.5
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	WITH 3 HP MISTBLASTER	18.3	18.3	18.3	18.3
LARGEST LOAD					
	HP	10	10	10	10
	KW	9.1	9.1	9.1	9.1
FILTER ELEMENT					
	WATER BASED COOLANT	5	5	5	5
	OIL BASED COOLANT	10	10	10	10

3.0. SPECIFICATIONS: (Cont.):

FCC REGULATIONS:

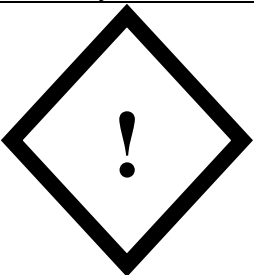

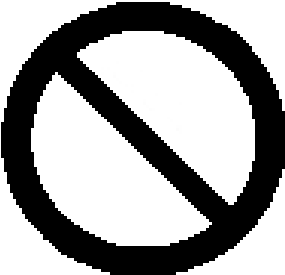
THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRE OPERATION.

****ALL SPECIFICATIONS, INSTRUCTION, PICTURES, AND ILLUSTRATIONS IN THIS MANUAL ARE BELIEVED TO BE ACCURATE AND MAY CONTAIN CHIPBLASTER INC. PROPRIETARY INFORMATION, WHICH IS PRIVILEGED, CONFIDENTIAL, OR SUBJECT TO COPYRIGHT / PATENT BELONGING TO CHIPBLASTER INC. THIS MANUAL IS INTENDED FOR THE OPERATION AND MAINTENANCE OF YOUR CHIPBLASTER UNIT. YOU ARE HEREBY NOTIFIED THAT ANY DISSEMINATION, DISTRIBUTION, COPYING, OR ACTION TAKEN IN REGARD TO THE CONTENT OF THIS MANUAL IS STRICTLY PROHIBITED AND MAY BE UNLAWFUL. CHIPBLASTER INC. ALSO RESERVES THE RIGHT TO CHANGE THE CONTENTS OF THIS MANUAL WITHOUT NOTICE. IF YOU HAVE ANY QUESTIONS PLEASE CONTACT CHIPBLASTER INC. AT (814) 724-6278.**




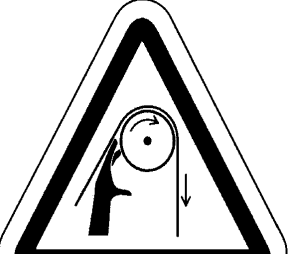

4.0. SAFETY PRECAUTIONS:

The items described in these instructions are a very important, so that you can use the ChipBLASTER safely, prevent injury to yourself and other people around you as well as prevent damage to property in the area. Thoroughly familiarize yourself with the symbols and indications shown below and then continue to read the manual. Make sure that you observe all warnings given.

4.1. EXPLANATION of MARKINGS:

Symbols	Meaning of Symbols
	DANGER Indicates that error in operation may lead to death or serious injury.
	WARNING Indicates that error in operation may lead to injury (*1) to people or that these errors may cause damage to physical property. (*2) *(1) Such things as injury, burns or shock that will require hospitalization or long periods of outpatient treatment. *(2) Physical property damage refers to wide-ranging damage to assets and materials.
	PROHIBITED Indicates prohibition (Don't do it). What is prohibited will be described in or near the symbol in either text or picture form.

4.1. EXPLANATION of MARKINGS (Cont.):

Symbols (Cont.)	Meaning of Symbols
	<p>MANDATORY</p> <p>Indicates something mandatory (must be done). What is mandatory will be described in or near the symbol in either text or picture form.</p>
	<p>PINCH POINT</p> <p>Any point where fingers may be pinched by lids or covers. Exercise caution when closing lids or covers. (Oil skimmer cover).</p>
	<p>CUTTING HAZARD</p> <p>Any point where exposed fan blades may cause a cutting hazard to fingers when guard or inlet hose is not in place. Do not operate without guard or inlet hose in place. (Inlet to MistBLASTER).</p>
	<p>PINCH POINT</p> <p>Any point where fingers may be pinched by the motion of a belt. Do not operate with guard or cover open. (Oil skimmer).</p>
	<p>LIFTING HAZARD</p> <p>Use caution when lifting filter bags from filter housing. Bags may be heavy depending on the material being machined.</p>


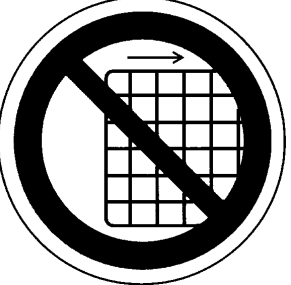
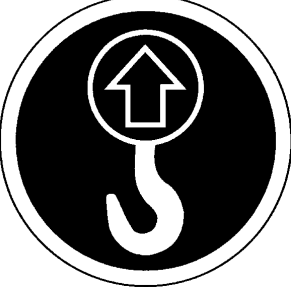


4.1. EXPLANATION of MARKINGS (Cont.):

Symbols	Meaning of Symbols
	<p>ELECTRICAL SHOCK HAZARD</p> <p>Shut off main disconnect before opening any electrical enclosures or junction boxes. <u>UNITS WITH ADJUSTABLE FREQUENCY DRIVES: BEFORE PERFORMING ANY WORK, BE AWARE THAT A DRIVE WILL HOLD A LETHAL CHARGE FOR A MINIMUM OF 10 MINUTES.</u></p>
	<p>LOCK OUT ELECTRICAL POWER</p> <p>Lock out and tag any and all disconnect switches before performing any maintenance work on equipment.</p>
	<p>SAFETY GLASSES REQUIRED</p> <p>When removing filter bags or working on equipment, safety glasses must be worn to prevent injury from splashing fluid or from other hazards.</p>
	<p>MACHINE STARTS AUTOMATICALLY</p> <p>ChipBLASTER equipment will start without operator input. Do not remove any guards or covers until disconnect switches are shut off, locked out and tagged.</p>
	<p>UNPLUG SOURCE OF ENERGY</p> <p>Before performing any work on items, such as the oil skimmer, unplug the unit.</p>

4.1. EXPLANATION of MARKINGS (Cont.):

Symbols (Cont.)	Meaning of Symbols (Cont.)
	<p>NO ACCESS FOR UNAUTHORIZED PERSONS</p> <p>Do not open electrical enclosures or remove any guards if you have not been trained or do not have knowledge of the equipment.</p>
	<p>FORK TRUCK LIFTING POINT</p> <p>To transport equipment, forks of truck must be located between points indicated so that mechanical damage to machine will not result.</p>
	<p>SAFE OPERATING PRESSURE</p> <p>Safe operating pressure will be listed below symbol in PSIG and Bar. Do not operate above stated pressures as equipment damage or personal injury will result.</p>
	<p>DO NOT STEP OR STAND ON</p> <p>Do not use surface as a step or platform when servicing equipment. Motors and electrical boxes are not designed to be used as steps or platforms and injury may result from falls.</p>
	<p>READ THE TECHNICAL MANUAL</p> <p>Before attempting to work on or repair this machine read and understand this manual. If certain procedures are not followed, mechanical and or personal injury will result.</p>

4.1. EXPLANATION of MARKINGS (Cont.):

Symbols (Cont.)	Meaning of Symbols (Cont.)
	<p>WEAR SAFETY GLOVES</p> <p>When changing filter bags it is recommended to wear safety gloves to protect hands from metal chips and the coolant that may be used in the machine.</p>
	<p>DO NOT OPERATE WITH GUARD REMOVED</p> <p>Do not operate machine with guards removed as hazards to personnel will be present and injury to personnel could result.</p>
	<p>LIFTING POINT</p> <p>Machine must only be lifted at points indicated in order to avoid mechanical damage and personal injury. Lifting slings or chain slings must be adequately sized to carry the weight of the MistBLASTER. Refer to MistBLASTER footprint drawing for actual weight.</p>
	<p>BURN HAZARD HOT SURFACE</p> <p>Surface of transformer will become hot after extended periods of operation. Do not set anything on transformer or restrict airflow around transformer. DO NOT TOUCH.</p>
	<p>INHALATION HAZARD</p> <p>Consult MSDS Sheet for Hazard Listings Possible Coolant Mist Emission</p>

5.0. STORAGE:



4.1

- 5.1. If the ChipBLASTER is to be stored for any period of time it must be kept in an area that is protected from freezing. Freezing temperatures will damage the pumps and the valves. Keep ChipBLASTER covered until ready to move to site. If MistBLASTER is also supplied keep covered.

6.0. MOVING MACHINE:



- 6.1. When moving the ChipBLASTER to the final site the following must be adhered to:
- 6.1.1. Lift ChipBLASTER only from the opposite end of the electrical enclosure. Forks must extend the full distance under ChipBLASTER.
 - 6.1.2. The fork truck lifting capacity must be sufficient to safely lift the ChipBLASTER without tipping. Refer to footprint drawing (Section 23) for machine dry weight.



MOVE SLOWLY AS NOT TO DROP THE ChipBLASTER.



DO NOT TRY TO MOVE ChipBLASTER WITH FLUID IN TANK.



DO NOT STAND UNDER ChipBLASTER AT ANY TIME.

If MistBLASTER is supplied with ChipBLASTER:

- 6.2. When lifting or moving the MistBLASTER, lift only at the eye bolts provided on the top.
6.3. Sling must be of sufficient capacity to safely lift the MistBLASTER.



DO NOT STAND UNDER MistBLASTER AT ANY TIME.



DO NOT MOVE A ChipBLASTER WITH A MistBLASTER MOUNTED ON TOP.

7.0. PLACING A ChipBLASTER:

- 7.1. After you receive your new ChipBLASTER unit the first thing you need to do is prepare the site where you would like to place the unit.



INSTALLATION SITE MUST BE FLAT AND LEVEL.

- 7.1.1. You need to keep the unit within 10' of the machining center that you are connecting the ChipBLASTER to.
 - 7.1.2. Locate the unit so the ChipBLASTER's electrical cabinet is within 15' of the machining center's electrical cabinet.
 - 7.1.3. Make sure you place the unit so maintenance can easily get to the filter housing and electrical cabinet on the ChipBLASTER unit. Refer to footprint drawing (Section 23) for recommended clearances.
- 7.2. After you have the site cleared for the ChipBLASTER unit you are ready to prepare the ChipBLASTER.
- 7.2.1. Remove the lumber that is used to hold the unit in place during transportation using a phillips screw driver or an electric screw gun.
 - 7.2.2. Before you remove the ChipBLASTER from the skid take a moment and remove the lid from the top of the ChipBLASTER unit. Remove the bag containing the leveling feet.
 - 7.2.3. When removing the ChipBLASTER only from the opposite end of the electrical enclosure.
 - 7.2.4. Insure the forks extend completely under the ChipBLASTER unit to the support.



DO NOT AT ANY TIME REACH UNDER THE ChipBLASTER UNIT OR STAND UNDER THE ChipBLASTER UNIT WHILE IT IS SUPPORTED BY A FORK TRUCK. IF YOU MUST REACH UNDER THE MACHINE BLOCK IT UP FOR SAFETY.

- 7.2.5. The EV units are shipped from the factory with leveling feet as shown in figure 1a. The leveling feet must be installed when setting up the ChipBLASTER.
- 7.2.8. After you remove the ChipBLASTER from the skid take the set of four feet and install the studs of the leveling feet through the holes in the legs. Block unit while installing feet for safety. Reference; top of foot to the bottom of second nut (1"). The feet have two functions the first being to level the ChipBLASTER unit and the second being to help eliminate the transfer of noise. Refer to figure 1.
- 7.2.9. After you have the feet in place proceed with moving the ChipBLASTER into place.

7.0. PLACING A ChipBLASTER (Cont.): Mounting feet installation

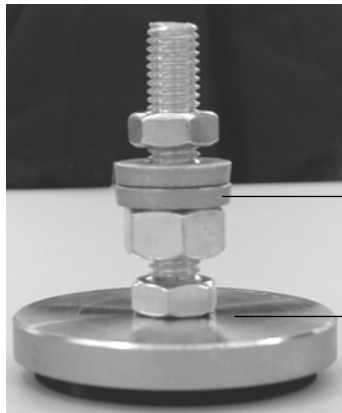


Figure 1

Recommended
1 inch (25.4 mm)

EV



Upon positioning the unit, go ahead and level the machine. The ChipBLASTER must be level to insure proper operation. Remember the ChipBLASTER unit has float switches and an overflow, if the unit is not level these items may not work properly. After ChipBLASTER is in place and level, remove all items from inside of the tank.. Items located in the tank are: hoses, filter bag(s), and pre-filters. Place all hoses at the back of the unit (same end as filters).

7.2.10. After you remove everything from inside the tank, you are now ready to either contact ChipBLASTER, Inc. to schedule installation or proceed yourself depending on your agreement.



POWER FOR ChipBLASTER MUST BE AVAILABLE BEFORE SCHEDULING INSTALLATION.

8.0. MECHANICAL INSTALLATION:

8.1. PLUMBING INSTALLATION:

- 8.1.1. When you are ready to start the installation of the ChipBLASTER unit you first must locate the high-pressure hoses that ChipBLASTER Inc. has provided. Connect the female end to the ChipBLASTER outlet 1 and 2 hoses located on the filter side lower right, then connect the other ends to the machining center (spindle, turret or other designated tool/orifice).
- 8.1.2. Next you will want to find the 1" clear hose, this will be for the return line. For units that do not have a ChipBLASTER supplied return/transfer pump, connect the 1" clear hose to the 1" inlet on the ChipBLASTER reservoir tank. The other end will connect either to the existing machining center coolant pump. For units that are supplied with a return/transfer pump, connect the 1" clear hose to the inlet of the return/transfer pump and connect the other end to the 1" hose barb of the standpipe assembly after installation on the machine tool sump.
- 8.1.3. For best use, the inlet of the 1" clear hose in the machining center coolant sump should be approximately 1" from the bottom of the coolant Sump. If using the standpipe assembly position the suction pipe (pipe with 45 degree taper) 1" from bottom of machine tool sump, this should be connected to the inlet of the return/transfer pump.
- 8.1.4. Connect the 1 1/2" hose to the overflow outlet barb on the side of the ChipBLASTER tank. The other end of this hose should go to the machining center coolant tank. If using the standpipe assembly connect the 1 1/2" to the hose barb.



THE RETURN PUMP MUST BE WITHING 12 FEET OF THE MACHINING CENTER COOLANT TANK.

9.0. ELECTRICAL INSTALLATION:



INSTALLER MUST COMPLY WITH ALL LOCAL AND NATIONAL ELECTRICAL CODES AND SAFETY GUIDELINES WHEN MAKING ELECTRICAL CONNECTIONS TO THE ChipBLASTER.

REFER TO THE ELECTRICAL DRAWING(S) (SECTION 20) DURING ELECTRICAL INSTALLATION. ALSO REFER TO THE FOOTPRINT DRAWING (SECTION 23) FOR RECOMMENDED WORK CLEARANCE.



BEFORE OPENING THE MACHINING CENTER CABINET DISCONNECT AND LOCKOUT / TAGOUT ALL ELECTRICAL ENERGY SOURCES.

*NOTE-The ChipBLASTER is equipped to accept control interface voltages of 115vac or 24vdc. Please make sure the appropriate control voltage relays are installed in CR1 through CR4. Before applying control power to the unit. The unit is shipped from the factory with 115vac relays installed in CR1, CR2, CR3, CR4. We also include the 24vdc relays loose in the electrical cabinet for interfacing convenience to 24vdc machines.

9.0. ELECTRICAL INSTALLATION (Cont.):

9.1. CONTROL INTERFACE EV

For Control Interface instructions please refer to The Chipblaster with THINC® Control Installation Procedure received with the Chipblaster.

9.3. POWER SUPPLY CONNECTIONS:



REFER TO ChipBLASTER DATA NAMEPLATE FOR CORRECT SUPPLY VOLTAGE. DO NOT EXCEED AMP RATING OF MACHINING CENTER BREAKER IF CONNECTING TO LOAD SIDE. IF CONNECTING TO A MAIN DROP, SIZE DISCONNECT AND WIRE BASED ON INFORMATION SUPPLIED ON THE ChipBLASTER NAMEPLATE.

9.3.1. The EV is supplied from the factory with a 12 pin plug and receptacle. If the receptacle is not used wire L1, L2 and L3 to the line (top) of the main circuit breaker (1CB). Wire the PE from the machining center to the ground terminal in the ChipBLASTER control panel, otherwise connect L1 to terminal 1, L2 to terminal 2 and L3 to terminal 3. Connect PE to the ground terminal of the receptacle.

10.0. START – UP:

10.1. Fill the ChipBLASTER reservoir with clean coolant to within 3” (76 mm) of top. DO NOT OVERFILL.



10.1. If machine tool sump is not full, top off as required. DO NOT OVERFILL.

10.2. If ChipBLASTER’s optional return (transfer) pump is used; **the pump must be primed.**

10.3.1. Remove the fill line from the inlet of the ChipBLASTER tank.

10.3.2. Fill line with clean coolant.

10.3.3. Manually energize return (transfer) pump motor starter (MR3).

9.7 – 9.8

10.3.4. The return (transfer) pump should now pull from machine tool sump.

10.3.5. If pump does not pull fluid from machine tool sump repeat the above steps.



CHECK MOTOR ROTATIONS. PLEASE REFER TO BELOW.

9.3 – 9.4



CHECK FILTER PUMP ROTATION. ROTATION IS CLOCKWISE VIEWED FROM FAN END



CHECK MAIN PUMP ROTATION. ROTATION IS COUNTER CLOCKWISE VIEWED FROM THE SHAFT END.



CHECK RETURN PUMP ROTATION (IF USED). ROTATION IS CLOCKWISE VIEWED FROM FAN END.

11.0. SYSTEM AIR PURGE:

11.1. SINGLE FILTER

- 11.1.1. Open the 1/4" petcock located on both the filter and post filter, so that trapped air can escape both filters.
- 11.1.2. Press the **(RESET / AIR PURGE)** push button, to remove the air from the filters. When all of the air has escaped, close the petcocks. This will lower the tank level and start the return (transfer) pump and lower the sump level. Depending on the capacity of the machine tool sump, the lower level will allow the ChipBLASTER high pressure to fill the sump without overflowing the machine tool sump. Unless the sump is completely emptied **DO NOT REFILL MACHINE TOOL SUMP.**
- 11.1.3. Start the ChipBLASTER and check for any coolant leaks.
- 11.1.4. Insure that all electrical circuits are operating correctly.
- 11.1.5. The coolant outlet pressure is factory preset to run at 1000 PSIG (69 bar), or a customer specified pressure. Refer to Pressure Adjustment Procedure. (Section 16.0).

11.0. SYSTEM AIR PURGE (Cont.):

11.2. DUAL FILTER

- 11.2.1. Open the 1/4" petcock located on both the filters and post filter, so that trapped air can escape both filters.
- 11.2.2. Rotate the ball valve handle to the "RUN FILTER A" position. See Figure 4.



Figure 4
"Run filter A"

- 11.2.3. Press the **(RESET / AIR PURGE)** push button, to remove air from the filter and post filter. When all the air has escaped from the filters close the 1/4" petcock on filter "A".
- 11.2.4. Rotate the ball valve handle to the "RUN FILTER B" position. See figure 5.



Figure 5
"Run filter B"

11.0. SYSTEM AIR PURGE: (Con't)

- 11.2.5. Press the **(RESET / AIR PURGE)** push button, to remove air from the filter and post filter. When all the air has escaped from the filters close the 1/4" petcock on filter "B" and on the post filter. This will lower the tank level and start the return (transfer) pump and lower the sump level. Depending on the capacity of the machine tool sump, the lower level will allow the ChipBLASTER high pressure to fill the sump without over flowing the machine tool sump. Unless the sump is completely emptied **DO NOT REFILL MACHINE TOOL SUMP**.
- 11.2.6. Start the ChipBLASTER and check for any coolant leaks.
- 11.2.7. Insure that all electrical circuits are operating correctly.
- 11.2.8. The coolant outlet pressure is factory preset to run at 1000 PSIG (69 bar), or a customer specified pressure. Refer to Pressure Adjustment Procedure. (Section 16.0).

11.3. AUTOCROSS

11.2

- 11.3.1. Open the 1/4" petcock located on both the filters and post filter, so that trapped air can escape both filters.
- 11.3.2. Press the **(RESET / AIR PURGE)** push button, to remove air from the filters and post filter. When all the air has escaped from the filters close the 1/4" petcocks. This will lower the tank level and start the return (transfer) pump and lower the sump level. Depending on the capacity of the machine tool sump, the lower level will allow the ChipBLASTER high pressure to fill the sump without over flowing the machine tool sump. Unless the sump is completely emptied **DO NOT REFILL MACHINE TOOL SUMP**.
- 11.3.3. Start the ChipBLASTER and check for any coolant leaks.
- 11.3.4. Insure that all electrical circuits are operating correctly.



DO NOT RUN THE HIGH-PRESSURE PUMP DRY FOR ANY PERIOD OF TIME. CAVITATION WILL RESULT IN FAILURE OF THE PUMP. ALWAYS REMEMBER TO CHECK THAT ALL PLUMBING VALVES ARE OPEN AND THAT PUMPED COOLANT CAN FLOW FREELY TO THE INLET OF THE HIGH- PRESSURE PUMP.

12.1. ELECTRICAL OPERATION:



- 12.1.1. Energizing CR1 will start the automatic operation on the coolant system and provide coolant out of solenoid #1. At this time the filter pump and the main drive will come on line.
- 12.1.2. Energizing CR3 (index#1) will stop coolant flow out of solenoid #1 and place the unit into an idle condition. This state is primarily used for tool changes on turning center applications.
- 12.1.3. De-energizing CR3 will return the unit to normal operation.
- 12.1.2. The coolant systems return pump will run automatically and independent of CR1. This pump is controlled through the PLC via the tank level switch.

12.2. COOLANT FLOW (Refer to figures 6 through 6b)

- 12.2.1. Coolant flow is divided into two groups, High-pressure and Low-pressure. Low- pressure is the flow of coolant from the fourth compartment of the ChipBLASTER's tank to the high-pressure pump. High-pressure is the flow of coolant from the high-pressure pump to the nozzle outlet or tool, at the machining center.
- 12.2.2. LOW-PRESSURE – Low-pressure leaves the fourth compartment of the ChipBLASTER's coolant tank and goes to the filter pump. The filter pump pumps the coolant into a large filter where it will be filtered to 5 micron. If a post-filter is used, it will be in series with the larger filter. If the filters gets dirty a flashing red lamp will give an alarm. After filtration, the coolant is then sent through a post filter which is used to protect the high pressure pump in the event the bag filter was incorrectly changed. A steady red light will indicate a dirty post filter. The coolant is sent to the high pressure pump.
- 12.2.3. HIGH-PRESSURE - High-pressure coolant leaving the pressure pump goes to the manifold block, which consists of an unloader, 3000-psi (206 Bar) pressure gauge, solenoids, transducer, pulsation dampener and a pressure switch (optional). The unloader is adjustable to blow off coolant at 200 psi (13.7 Bar) above the normal running pressure to prevent any over pressure in the high-pressure coolant system. The blow off coolant is then returned to the first compartment in the ChipBLASTER's tank through a check valve. The dampener unit is installed to dampen the fast changes in coolant pressure. A pressure gauge is installed to read the overall pressure between the high-pressure pump and the nozzle's outlet at the machining center. The transducer reads the overall pressure and produces an error voltage that is fed back to control the speed of the variable drive(1AFD). The optional pressure which is only used to produce an error signal if there is a reduction of pressure below 300 psi (20.6 Bar). The solenoids are used for diverting the coolant for different machine operations. The high-pressure coolant leaves the manifold block and flows through the machining center to the tool being used.

12.0. OPERATION (Cont.):

- 12.2.4. The **RETURN (TRANSFER) PUMP** is a separate system but is very important. It must maintain the levels of the coolant in the ChipBLASTER's coolant tank and the machining center's coolant tank. The return pump returns coolant from the machining center's sump to the ChipBLASTER's coolant tank. The float assembly in the ChipBLASTER's coolant tank will maintain all coolant levels including the machining center's sump.
- 12.2.5. If the ChipBLASTER is to be operated from a **CENTRAL COOLANT SUPPLY** the ChipBLASTER will be supplied with a fill solenoid valve and regulator in place of a return pump. The fill solenoid will operate based on the float assembly in the ChipBLASTER's coolant tank and will maintain the tank coolant level. The central supply system must be capable of supplying at least 1.5 times the flow rate of the ChipBLASTER model being used. The supply pressure should be in the range of 20 to 30 PSIG (1.4 to 2 bar). The maximum particle size should not exceed 100 micron.
- 12.2.6. **LOW PRESSURE FLOOD** is a factory installed feature. It is designed to be used to supply filtered coolant at 5 gpm (18.9 liters/minute) 35 psig (2.4bar) maximum. **The flow and pressure is dependent on orifice diameter.** The low pressure flood is controlled by a separate maintained "M" code from the machine tool. The low pressure, as supplied from the factory, is available at coolant outlet number 1 and/or 2, depending on ChipBLASTER model. The low pressure flood is used to flush parts, tool plates and general chip clearing.
NOTE: If the low pressure flood coolant is in use; high pressure coolant is not available.
- 12.2.7. **HIGH / LOW PRESSURE** is available as a factory option if high pressure coolant is required from one coolant outlet and low pressure flood coolant is required from the other coolant outlet at the same time. The low pressure coolant as supplied from the factory is available, as standard, on coolant outlet number 1. **NOTE: If HIGH/LOW PRESSURE is required for both coolant outlets a second HIGH/LOW PRESSURE option must be purchased.** The low pressure is designed to be used to supply filtered coolant at 5 gpm (18.9 liters/minute) 35 psig (2.4bar) maximum. **The flow and pressure is dependent on orifice diameter.** The low pressure flood is controlled by a separate maintained "M" code from the machine tool.
- 12.2.8. **LOW PRESSURE HOSE WASH DOWN** is also available as an option to provide low pressure filtered coolant through a 20'-0" (6 meter) "garden" hose. Refer to SECTION 27.19 for a complete description of this option.

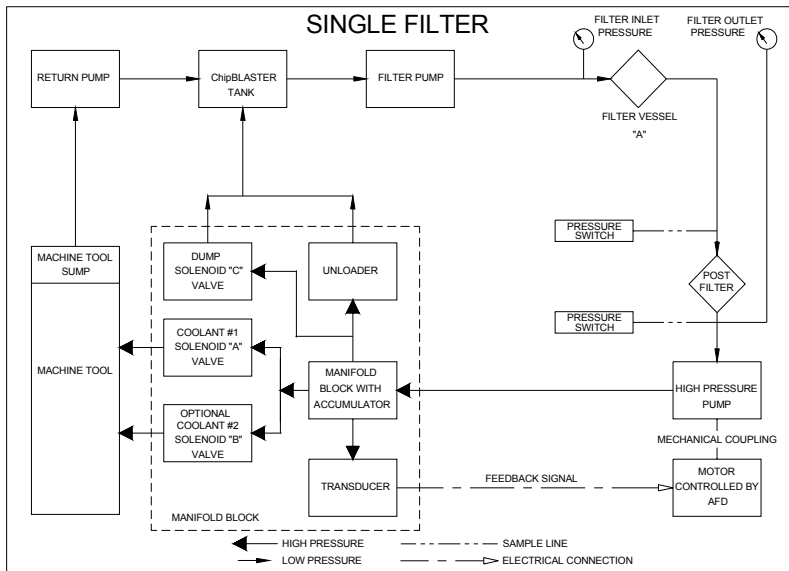


Figure 6 (JV, EV units)
Single filter

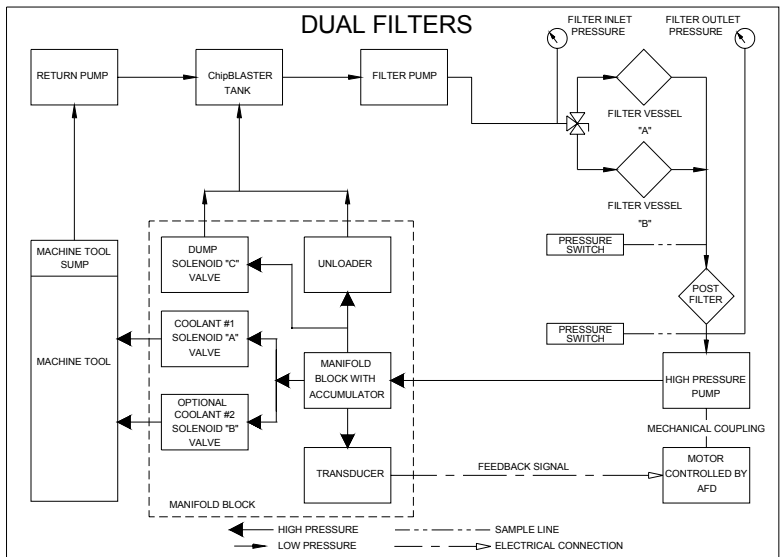


Figure 6a (JV, EV units)
Dual filters
Manual change over

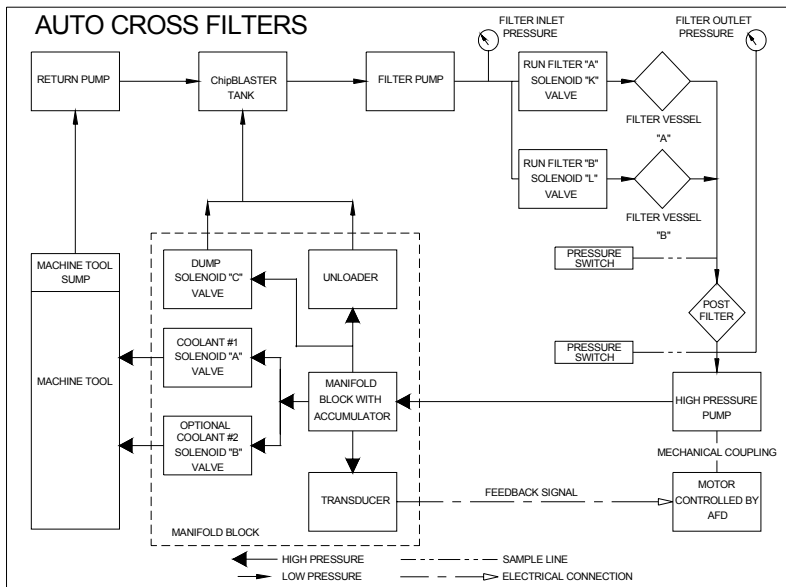


Figure 6b (JV, EV units)
Autocross filters
Automatic change over

12.0. OPERATION: (Cont.):**12.3. THEORY OF OPERATION AUTO CROSS OPTION:**

- 12.3.1. The ChipBLASTER is designed to operate with two (2) filters. The ChipBLASTER will typically start on filter A and run until this filter becomes clogged (dirty). When the filter becomes clogged (dirty) the flow will be switched to filter B automatically. The red tower light will begin to flash indicating a clogged (dirty) filter A. The ChipBLASTER will continue to operate.
- 12.3.2. While the ChipBLASTER is running on filter B, filter A can be changed. (refer to Section 14.9 for procedure)
- 12.3.3. When the ChipBLASTER is running on filter B and it becomes clogged (dirty) the ChipBLASTER will go to an emergency stop condition after the “call for coolant” is shut off. This will prevent damage to the high pressure pump.
- 12.3.4. It should be noted the filter bag A or B is monitored when the ChipBLASTER is operating. The post filter is also monitored when the ChipBLASTER is operating. If the post filter becomes dirty the red tower light will turn on steady. The reason the post filter can become dirty is do to improper changing of the filter bags. Improper changing will allow chips or contaminates into the bottom of the filter housing which than pass to the post filter. The post filter is designed to prevent chips or contaminates from going through the high pressure pump and damaging the seals. The post filter also prevents chips or contaminates from damaging solenoid vales and pressure switches. 12.2
- 12.3.5. Refer to figure 6b section 12.2 for flow diagram
- 12.3.6. The autocross units are also equipped to change from filter “A” to “B” after a timed period. This prevents coolant in filter “B” from becoming stagnate and allowing algae to grow. The ChipBLASTER will start out on filter “A” and after one (1) hour of accumulated run time the flow will be diverted through filter “B”. Filter “B” will be used for twenty (20) minutes and than change back to filter “A”. This cycle will repeat until a filter becomes dirty at which time the timed change over will be stopped until the filters are changed. During the timed change over the filters will still be monitored.



DO NOT ALLOW CHIPS OR CONTAMINATES TO FALL OUT OF FILTER BAGS INTO FILTER HOUSING WHEN CHANGING BAGS.



DO NOT POUR COOLANT FROM BAG INTO FILTER HOUSING, POUR INTO MACHINE TOOL SUMP.



DO NOT POKE HOLES IN BAG WHEN LIFTING OUT OF FILTER HOUSING.



DO REFER TO SECTION 14.9 FOR CORRECT PROCEDURE FOR CHANGING FILTER BAGS.

DO NOT REUSE DIRTY FILTER BAG.



13.0. ALARMS:

13.1. THE FOLLOWING ERRORS WILL STOP THE OPERATION ON THE COOLANT SYSTEM AND CAUSE THE ES RELAY TO CHANGE STATES:

- 13.1.1. Main drive fault.
- 13.1.2. Filter pump overload.
- 13.1.3. Return pump overload.
- 13.1.4. Monitored circuit breaker trip.
- 13.1.5. Dirty “A” filter at end of cycle. De-energize “call for coolant”. (Single filter unit).
- 13.1.6. Dirty “B” filter at end of cycle. De-energize “call for coolant”. (Auto cross over option).
- 13.1.7. Dirty post filter at end of cycle. De-energize “call for coolant”.
- 13.1.8. Low coolant level in the ChipBLASTER coolant tank
- 13.1.9. High pressure to the machining center is below 300 PSI (20.6 Bar) - (with no alarm). This requires an optional pressure switch to be purchased with ChipBLASTER.

13.2. THE FOLLOWING ERRORS WILL CAUSE THE ALARM TO SOUND:

- 13.1.1. Any motor overload (constant blast).
- 13.1.2. Monitored circuit breaker trip (constant blast).
- 13.1.3. Low coolant limit (intermittent blast).
- 13.1.4. Post filter for one (1) hour without de-energizing “call for coolant”.
- 13.1.5. Flow rate of coolant from the machining center’s coolant tank sump to the ChipBLASTER tank is less than 8 GPM [30.2 l/min] (intermittent blast/warning only). SLOW COOLANT RETURN.

13.3. THE FOLLOWING ERROR WILL CAUSE THE ERROR LIGHT TO FLASH:

- 13.3.1. Dirty “A” filter either a single, dual or autocross filter system.

13.4. THE FOLLOWING WILL CAUSE THE ERROR LIGHT TO TURN ON STEADY:

- 13.4.1. Post filter dirty.

13.5. TO RESET A FAULT:

- 13.5.1. Determine the cause of the fault and correct. Press **RESET / AIR PURGE** push button on enclosure door. Re-energize the required “M” code to start the ChipBLASTER.

14.0. PREVENTATIVE MAINTENANCE:**14.1. PREVENTATIVE MAINTENANCE SCHEDULE:**

V MODEL MAINTENANCE CHART								REF.
COMPONENT	TASK		40 HRS	172 HRS	688 HRS	1376 HRS	2080 HRS	
	CHECK OIL LEVEL	REPLACE OIL EVERY 2000 HR. OR *	WEEKLY	MONTHLY	QUARTERLY	SEMIANNUAL	ANNUALLY	MANUAL SECTION
HIGH PRESSURE PUMP (MOBIL 1 15W-50)			X				X	14.2
						X		14.3
								14.4
					X			14.5
								14.6
FILTER PUMP	CHECK FOR LEAKS	REBUILD PUMP AT 10,000 OR * EVERY 2 YEARS			X			14.9
BAG FILTER UNIT	CHECK PRESSURE GAUGES		X					14.12
	REPLACE FILTER BAGS WHEN ALARMED OR				X			14.13
	CHECK FOR LEAKS				X			14.17
	CHANGE POST FILTER				X			14.18
SOCK FILTER	REPLACE 300um SOCK FILTER				X			14.19
PILOT LAMP, STACK LIGHT	CHECK LAMPS		X					14.21
FLOAT UNIT	CLEAN FLOAT STEM			X				14.23
TANK	CLEAN TANK						X	14.25
PUMP MOTORS	CHECK MOUNTING BOLTS						X	14.27
TRANSFER (RETURN) PUMP (IF SUPPLIED BY ChipBLASTER)	CLEAN PUMP CAVITY					X		14.29
	CHECK FOR LEAKS				X			14.30
	CHECK ALL INLET AND OUTLET PLUMBING FOR BLOCKAGE				X			14.31
LDENS FILTER (IF EQUIPPED)	REPLACE CARTRIDGE				X			14.34
EQUIPMENT COOLING FANS	CLEAN FANS						X	14.37

* THIS NORMAL MAINTENANCE SCHEDULE IS DESIGNED FOR A SINGLE 8 HOUR SHIFT. IF THE OPERATING TIME IS MORE THAN 1 SHIFT A DAY THAN THE HOURS IN THE TASK COLUMN MUST BE USED IN ORDER TO PREVENT DOWN TIME ON THE EQUIPMENT.

14.0. PREVENTATIVE MAINTENANCE (Cont.):

14.2. CHECKING HIGH PRESSURE PUMP OIL:

14.2.1. The high pressure pump oil may be checked by observing the level in oil sight glass located on exterior of the ChipBLASTER.



Typical sight glass mounting

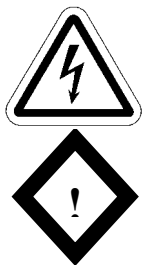
EV13, EVHP

OIL SIGHT
GLASS

14.2.2. The oil level must be maintained between the full and add mark. If required add oil (refer to Section 14.3.2.5.)



**FAILURE TO USE
MOBIL 1 FULLY-SYNTHETIC 15W-50 WILL
VOID YOUR WARRANTY**



**DO NOT ATTEMPT ANY SERVICE ON ChipBLASTER UNIT
WITH POWER ENERGIZED. REMOVE ALL ENERGY
SOURCES AND LOCK OUT / TAG OUT.**

14.0. PREVENTATIVE MAINTENANCE (Cont.):

14.3. OIL CHANGE PROCEDURE:



IT IS EXTREMELY IMPORTANT TO DISCONNECT AND LOCKOUT ANY AND ALL POWER SOURCES BEFORE ANY WORK IS TO BE PERFORMED ON the ChipBLASTER UNIT.

14.3.1. ChipBLASTER High-Pressure Pump: Change the crankcase oil every 2000 hours.

USE:

For ChipBLASTER Inc. pump 2106 - Mobil 1 fully-synthetic 15W-50.



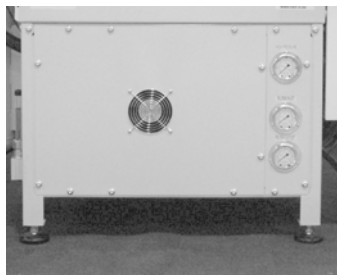
**FAILURE TO USE
MOBIL 1 FULLY-SYNTHETIC 15W-50 WILL
VOID YOUR WARRANTY**

Other Pumps and Motors: All have sealed bearings, no lubrication is necessary.

14.3.2. Oil Change Procedure.

14. 3.2.1 ChipBlaster High Pressure pump: Change the crankcase oil every 2000 hrs.

14.3.2.2. Remove accesses panel (use 6mm hex wrench).



Typical access panel

14.3.2.3. Locate OIL SIGHT GAUGE ASSEMBLY and remove plug. (use 8mm hex wrench). Allow to drain into a container. For a single pump unit there will be 32 ounces (0.9 liters) for a two pump unit there will be 64 ounces (1.9 liters). NOTE: In a two pump unit both pumps will be drained at the same time.

DRAIN
PLUG
LOCATION



14.0. PREVENTATIVE MAINTENANCE (Cont.):

14.3.2. OIL CHANGE PROCEDURE (Cont.):

14.3.2.4. After oil is drained from pump reinstall the plug in oil sight gauge assembly. Torque to 180 In LB. (20 Nm).



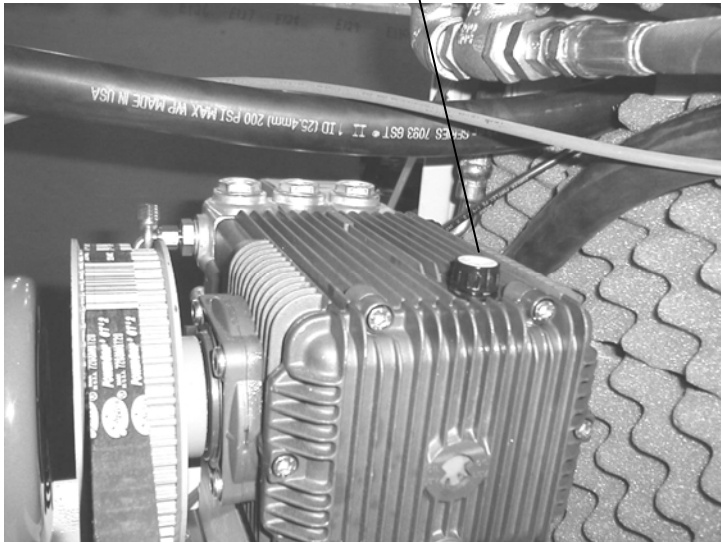
BE SURE TO INSPECT NYLON WASHER TO INSURE IT IS NOT DAMAGED.



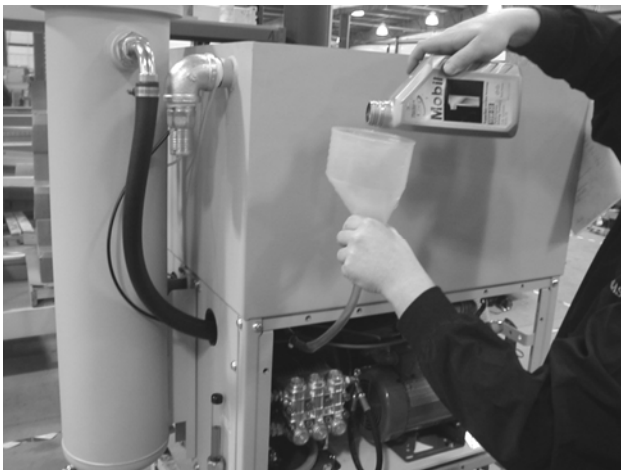
PROPERLY DISPOSE OF OIL PER LOCAL REGULATIONS. DO NOT REUSE OIL.

14.3.2.5. Locate High Pressure Pump (p/n 2106) and remove dip stick (LOCATED AT TOP OF PUMP) Place a small funnel in dipstick opening.

OIL FILL
CAP



Single pump unit



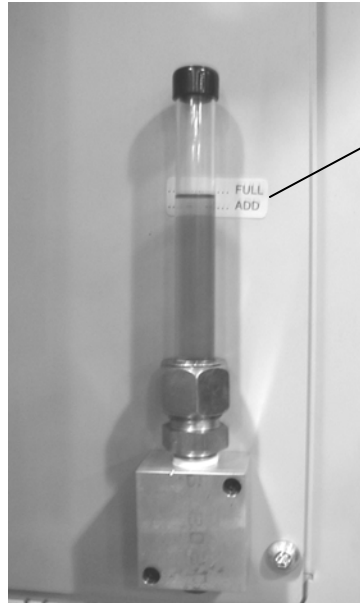
Refilling pump with MOBIL 1 TRI-SYNTHETIC 15W-50

NOTE: IN A TWO PUMP UNIT ONLY ONE PUMP WILL NEED FILLING AS FLUID WILL SELF LEVEL.

14.0. PREVENTATIVE MAINTENANCE (Cont.):

14.3.2. OIL CHANGE PROCEDURE (Cont.):

14.3.2.6. Add only (MOBIL 1 FULLY-SYNTHETIC 15W-50) Bring oil level to “ADD” indicator mark on sight glass.



FULL / ADD
INDICATOR
LABEL

14.3.2.7. Allow oil to settle for 3 to 4 minutes.

14.3.2.8. Check level and if required add small amounts slowly until level is at “FULL” indicator.

14.3.2.9. Reinstall dipstick plug. Do not over tighten.

14.3.2.10. Reinstall gauge panel. Tighten BHCS to 200 In Lb (22 Nm).
BE CAREFUL NOT CRIMP GAUGE TUBING LINES.



**DO NOT RUN HIGH PRESSURE RUN WITHOUT OIL AS
DAMAGE WILL RESULT AND VOID YOUR WARRANTY.**



**DO NOT ATTEMPT ANY SERVICE ON ChipBLASTER UNIT
WITH POWER ENERGIZED. REMOVE ALL ENERGY
SOURCES AND LOCK OUT / TAG OUT.**

14.0. PREVENTATIVE MAINTENANCE (Cont.):**14.4. HIGH PRESSURE PUMP – CHECK BELT(s):**

- 14.4.1. To check the high pressure pump drive belt, the panel to the left of the gauge panel will need to be removed, using a 6 mm hex wrench.
- 14.4.2. Check belt tension. Refer to SECTION 18.0.
- 14.4.3. To adjust motor to pump drive belt turn the adjustment bolt on the pump mounting base using a 9/16" socket. To tighten belt turn the adjustment screw counter clockwise, to loosen belt, turn the adjustment screw clockwise.
- 14.4.4. Replace panel before operating the ChipBLASTER.

14.5. HIGH PRESSURE PUMP – CHECK FOR LEAKS:

- 14.5.1. Remove the panel to the left of the gauge panel using a 6 mm hex wrench.
- 14.5.2. Check for leaks around pump head and on sub plate.
- 14.5.3. Verify the fluid is not coming from a fitting or hose. If a hose is leaking shut down the ChipBLASTER unit and replace hose. If a fitting is leaking, check tightness of fitting.
- 14.5.4. If fluid is noticed the high pressure pump will require replacement. Contact ChipBLASTER service department.
- 14.5.5. Replace gauge panel before operating the ChipBLASTER unit.

14.6. HIGH PRESURE PUMP – REBUILD:

- 14.6.1. Due to the manufacturing tolerances required for the internal parts of the high pressure pump, rebuilding the high pressure it is not recommended. A new replacement pump can be purchased from ChipBLASTER. When ordering a new pump from the ChipBLASTER service department, advise the contact person that you wish to receive an RGA number for the pump to be replaced.
- 14.6.2. When the old pump is received at ChipBLASTER, the pump will be inspected for any damage. If no damage is noted a core charge credit will be issued.

14.9. FILTER PUMP – CHECK FOR LEAKS:

- 14.9.1. Remove the panel to the left of the gauge panel using a 6 mm hex wrench.
- 14.9.2. Check for leaks around pump head and on sub plate.
- 14.9.3. Verify the fluid is not coming from a fitting or hose. If a hose is leaking shut down the ChipBLASTER unit and replace hose. If a fitting is leaking, check tightness of fitting.

14.12. BAG FILTER UNIT(s): - CHECK PRESSURE GAUGES:

- 14.12. The inlet and outlet pressure gauges should read within 15 PSI (1 Bar) of each other. If the outlet filter gauge reads less than the inlet gauge this will be an indication of the bag filter becoming clogged. The JV units will indicate a dirty or clogged filter with a flashing red light.

14.0. PREVENTATIVE MAINTENANCE (Cont.):**14.13. FILTER CHANGING PROCEDURE:**

USE CARE WHEN CHANGING FILTER BAGS AS THEY MAY BE HEAVY DEPENDING ON MATERIAL BEING MACHINED. THE USE OF GLOVES AND SAFETY GLASSES IS STRONGLY RECOMMENDED DO TO THE CHIPS THAT MAY BE IN THE FILTERS.



DO NOT POKE HOLES IN FILTER BAG WHEN CHANGING.



DO NOT DUMP COOLANT FROM FILTER BAGS INTO ChipBLASTER TANK – DUMP COOLANT INTO MACHINE TOOL SUMP.



DO NOT REUSE DIRTY FILTER BAGS.

14.0. PREVENTATIVE MAINTENANCE (Cont.):**14.13.1. SINGLE FILTER:**

14.13.1.1. A flashing red light will indicate when the bag filter is dirty.



WHEN RUNNING A SINGLE FILTER THE SYSTEM MUST BE TURNED OFF BEFORE CHANGING THE FILTER.

14.13.1.2. Open the air bleed valve to remove any pressure from the filter housing. Then remove the filter lid.

14.13.1.3. Remove lid and inspect for damage. Be careful not to damage filter hold down plate, seal or springs. Set lid aside.

14.13.1.4. Remove optional hydrocyclonic filter (if used) from center of filter bag.

14.13.1.5. Pull the filter bag out of the housing.

14.13.1.6. Install the new filter bag in the housing insure it is all the way down.

14.13.1.6. Install optional hydrocyclonic filter (if used) into the center of filter bag.

14.13.1.7. Inspect the O-ring for cracks or tears, replace if damaged.

14.13.1.8. Inspect filter hold down seal for cracks or tears, replace if damaged.

14.13.1.9. Make sure the O-ring is in the proper groove before replacing the lid. Replace the filter lid by setting straight down so that the filter hold down plate will contact filter bag.

14.13.1.10. Torque filter lid cap screws to 30 FT LB (41Nm) in a star pattern.

14.13.1.11. Refer to SECTION 11 START UP FOR FILTER PURGE.

14.0. PREVENTATIVE MAINTENANCE (Cont.):**14.14. DUAL MANUAL FILTER: (CHIPBLASTER SHUT DOWN)**

The preferred method is to shut down the ChipBLASTER.

- 14.14.1. A flashing red light will indicate when the bag filter is dirty.
- 14.14.2. Open the air bleed valve to remove any pressure from the housing.
Then remove the filter lid.
- 14.14.3. Remove lid and inspect for damage. Be careful not to damage filter hold down plate, seal or springs. Set lid aside.
- 14.14.4. Remove optional hydrocyclonic filter (if used) from center of bag.
- 14.14.5. Pull the filter bag out of the housing.
- 14.14.6. Install the new filter bag in the housing insure it is all the way down.
- 14.14.7. Replace the optional hydrocyclonic filter (if used).
- 14.14.8. Inspect the O-ring for cracks or tears, replace if damaged.
- 14.14.9. Inspect filter hold down seal for cracks or tears, replace if damaged.
- 14.14.10. Replace the filter lid. Make sure the O-ring is in the proper groove before replacing the lid. Replace the filter lid by setting straight down so that the filter hold down plate will contact filter bag.
- 14.14.11. Torque filter lid cap screws to 30 FT LB (41Nm) in a star pattern.
- 14.14.12. Refer to SECTION 11 START UP FOR FILTER PURGE.



DO NOT POKE HOLES IN FILTER BAG WHEN CHANGING.



**DO NOT DUMP COOLANT FROM FILTER BAGS INTO
ChipBLASTER TANK – DUMP COOLANT INTO MACHINE TOOL SUMP.
DO NOT REUSE DIRTY FILTER BAGS.**



14.13–14.14

Handle at “RUN FILTER “A”



Handle at “RUN FILTER “B”

14.0. PREVENTATIVE MAINTENANCE (Cont.):**14.15. DUAL MANUAL FILTER: (CHIPBLASTER OPERATING)**

USE EXTREME CAUTION WHEN CHANGING THE FILTER BAG WHILE THE MACHINE IS IN OPERATION.



MAKE SURE TO LOCK OUT THE BALL VALVE TO PREVENT COOLANT FROM COMING THROUGH THE FILTER THAT IS BEING SERVICED. IF THE BALL VALVE IS POSITIONED TO DIRECT FLOW WHILE THE LID IS OFF POTENTIAL PERSONAL INJURY COULD RESULT.

- 14.15.1. Check the handle of the filter ball valve. If the handle is in the horizontal position (running "B" filter) than it is safe to change filter "A".
- 14.15.2. If the filter ball valve is in the vertical position (running "A" filter) then it is safe to change filter "B".
- 14.15.3. Make sure the air bleed petcocks are opened before changing the filter bag.
- 14.15.4. Remove lid and inspect for damage. Be careful not to damage filter hold down plate, seal or springs. Set lid aside.
- 14.15.5. Remove optional hydrocyclonic filter (if used) from center of bag.
- 14.15.6. Pull the filter bag out of the housing.
- 14.15.7. Install the new filter bag in the housing.
- 14.15.8. Replace the optional hydrocyclonic filter (if used).
- 14.15.9. Inspect the O-ring for cracks or tears, replace if damaged.
- 14.15.10. Inspect filter hold down seal for cracks or tears, replace if damaged.
- 14.15.11. Replace the filter lid. Make sure the O-ring is in the proper groove before replacing the lid. Replace the filter lid by setting straight down so that the filter hold down plate will contact filter bag. 14.15
- 14.15.12. Torque filter lid cap screws to 30 FT LB (41Nm) in a star pattern.
- 14.15.13. Refer to SECTION 11 START UP FOR FILTER PURGE.

14.0. PREVENTATIVE MAINTENANCE (Cont.):**14.16. AUTO CROSS OVER: ("A" filter change while unit is in operation).**

- 14.16.1. Change the filter only when the "CHANGE FILTER LIGHT" is flashing.
- 14.16.2. Place the "CHANGE FILTER" key switch in the change filter position. Remove the key.
- 14.16.3. Open the "A" filter petcock to make sure there is no pressure coming out of the filter housing.
- 14.16.4. If air or coolant is coming out of this valve. **DO NOT PROCEED, PLEASE CALL THE FACTORY FOR ASSISTANCE.**
- 14.16.5. Remove lid and inspect for damage. Be careful not to damage filter hold down plate, seal or springs. Set lid aside.
- 14.16.6. Remove optional hydrocyclonic filter (if used) from center of bag.
- 14.16.7. Pull the filter bag out of the housing. Close the filter air purge petcock.
- 14.16.8. Install the new filter bag in the housing.
- 14.16.9. Replace the optional hydrocyclonic filter (if used).
- 14.16.10. Inspect the O-ring for cracks or tears, replace if damaged.
- 14.16.11. Inspect filter hold down seal for cracks or tears, replace if damaged.
- 14.16.12. Replace the filter lid. Make sure the O-ring is in the proper groove before replacing the lid. Replace the filter lid by setting straight down so that the filter hold down plate will contact filter bag.
- 14.16.13. Torque filter lid cap screws to 30 FT LB (41Nm) in a star pattern.
- 14.16.14. Refer to SECTION 11 START UP FOR FILTER PURGE.



DO NOT CHANGE THE "B" FILTER WHILE THE UNIT IS RUNNING. THE "B" FILTER IS USED ONLY AS A BACKUP FILTER TANK TO CHANGE THE "A" FILTER WHILE THE UNIT IS RUNNING.

- 14.16.11. Both filters can be changed while the unit is shut off.
- 14.16.12. Refer to SECTION 11 START UP FOR FILTER PURGE after the filter(s) have been changed.

14.0. PREVENTATIVE MAINTENANCE: (Cont.):**14.16.13. FILTER REPLACEMENT FORM**

14.15-14.16

PLEASE MAKE A COPY OF THE FILTER REPLACEMENT FORM BEFORE ORDER...

ChipBLASTER, Inc.
 13605 South Mosiertown Road
 Meadville, PA 16335 USA
 Telephone 814-724-6278
 Fax 814-724-6287

P.O. No.: _____
 Contact Name: _____
 Phone No.: _____
 Shipping Instructions: _____

SHIP TO:
 Customer: _____
 Address: _____
 Address: _____
 City: _____
 State: _____
 Zip: _____
 Attention: _____

BILL TO:
 Customer: _____
 Address: _____
 Address: _____
 City: _____
 State: _____
 Zip: _____
 Attention: _____

PART No.	Description	Micron	Quantity
ChipBLASTER FILTERS			
3017-300	6" x 30" Prefilter Sock	300	
3013-5	8" x 30" Single Filter Bag	5	
3013-10	8" x 30" Single Filter Bag	10	
3013-15	8" x 30" Single Filter Bag	15	
3013-25	8" x 30" Single Filter Bag	25	
3013-100	8" x 30" Single Filter Bag	100	
3013-200	8" x 30" Single Filter Bag	200	
3014-15/5	8" x 30" Double Filter Bag	15/5	
3014-25/5	8" x 30" Double Filter Bag	25/5	
3536	Post Filter - Spin On	100	
3539	LDENS Sample Line Filter	5	
FILTER HOUSING ASSEMBLY REPAIR PARTS			
2571	Lid seal "O" ring	N/A	
3201A	Lid assembly	N/A	
MistBLASTER FILTERS			
3523	Electrostatic Filter	N/A	
3522	Grease Filter	N/A	
9650	Hepa Filter	N/A	
3521	Expanded Aluminum	N/A	

NOTE: Minimum order is \$25.00 USD - Consult factory for current pricing.

Unless your ChipBLASTER was ordered with a special micron level at your request, your unit was shipped from the factory with a 300 micron prefilter and a 5 micron (8" x 30") filter bag for a water based system or a 10 micron (8" x 30") filter for an oil based system.

14.0. PREVENTATIVE MAINTENANCE: (Cont.):**14.17. FILTER BAG ASSEMBLIES – CHECK FOR LEAKS:**

- 14.17.1. Check inlet and outlet hoses for leaks especially at hose clamps. If leaks are found replace hoses. THE ChipBLASTER MUST BE SHUT DOWN.

14.18. POST FILTER - CHANGING:**THIS CAN ONLY BE REPLACED WHEN THE ChipBLASTER IS SHUT DOWN.**

- 14.18.1. Change post filter when the filter light is on steady.
14.18.2. Unscrew and remove the post filter when dirty,
14.18.3. Remove gasket if it does not come off with filter.
14.18.4. Fill the new filter with clean coolant before replacing. This will speed up the purge time. USE THE SUPPLIED GASKET, install in groove in the post filter mounting base. Screw the filter into place being careful not to cross thread the filter. If the post filter is equipped with a petcock, open the petcock, and press the air purge button, (on the electrical panel), to remove air from the filter. When all of the air is purged from the filter, close the petcock.

**14.19. SOCK FILTER - CHANGING:**

- 14.19.1. This can only be replaced when the ChipBLASTER is shut down.
14.19.2. To remove, cut or untie the cord holding sock filter in place.
14.19.3. Slide the replacement sock filter in place over the fitting and tie securely.
14.19.4. To reorder sock pre-filters refer to form in SECTION 14.16.13.

14.23. FLOAT SWITCH - CLEANING:

- 14.23.1. Check float switch rod for build up of particulate material, BE CAREFUL NOT TO BEND THE ROD.
14.23.2. If float switch barrel has dirt build up inside it will be necessary to disassemble the switch assembly.
14.23.2.1. Remove the plug from the top using a 3/16" hex key.
14.23.2.2. Unscrew the float bulb from the brass rod.
14.23.2.3. Push the brass rod and magnetic carrier up until the magnetic carrier can be pulled out of the housing.
14.23.2.4. Clean the barrel of the housing with a round soft bristle brush.

**DO NOT LUBRICATE THE FLOAT ASSEMBLY AS THIS WILL CAUSE IMPROPER OPERATION.**

- 14.23.3. Re-assemble float switch. BE CAREFUL NOT TO BEND THE ROD.
14.23.4. Clean the float bulb also.
14.23.5. After cleaning insure the rod moves up and down freely without any binding.

NOTE: FLOAT STEM CLEANING MAY REQUIRE MORE FREQUENT CLEANING IF LARGE AMOUNTS OF TRAMP OIL IS PRESENT IN COOLANT RESERVOIR OR CUTTING OILS ARE USED.

14.0. PREVENTATIVE MAINTENANCE: (Cont.):**14.25. TANK - CLEANING:**

- 14.25.1. Coolant in the tank should be drained yearly so that the tank may be properly cleaned. 14.17-14.23
- 14.25.2. Dispose of fluid per local regulations.
- 14.25.3. Clean all baffles and replace.
- 14.25.4. After tank has been cleaned, all filters should be replaced.
- 14.25.5. The ChipBLASTER should be stated as a new unit. Refer to SECTION 10.0.

14.27. PUMP MOUNTING BOLTS – CHECK:

- 14.27.1. The filter pump mounting bolts should be checked for tightness. The recommended torque is 210 IN LB (24 Newton-meters).
- 14.27.2. The bolts for the main high pressure pressure pump to mounting rails should be torqued to 200 IN LB (23 Newton-meters).

14.29. RETURN PUMP (ChipBLASTER supplied) – CHECK FLOW RATE:

- 14.29.1. This pump should be checked every six months to insure the correct flow rate. If the flow rate has decreased, the pump should be rebuilt or replaced.
- 14.29.2. An indication the return pump may be clogged will be constant “SLOW COOLANT RETURN” warnings.
- 14.29.3. The ChipBLASTER must be powered down and the disconnect placed in the OFF position and locked out.
- 14.29.4. Remove the inlet and outlet hoses by loosening the hose clamps. Inspect the inlet and outlet for chips that may have accumulated, remove chips as required.
- 14.29.5. Remove the four (4) bolts using a 7/16” wrench that hold the casting in place.
- 14.29.6. Clean all chips from the casting and impeller. Be careful not to damage the back of the casting where it mates to the adapter as this is a metal to metal seal.
- 14.29.7. Re-assemble the casting and replace the four (4) bolts. Insure the casting is snugly in place. Check the shaft to insure it rotates freely. (Use the screwdriver slot in the motor to turn the shaft).
- 14.29.8. Re-install the inlet and outlet hoses and tighten the hose clamps securely.
- 14.29.9. Re-power the ChipBLASTER unit and check for leaks.

14.30. RETURN PUMP (ChipBLASTER supplied) – CHECK FOR LEAKS:

- 14.30.1. Check for leaks around the casting where it mates with the adapter.
- 14.30.2. If pump is leaking around casting, tighten the four (4) bolts. DO NOT OVER TIGHTEN.

14.31. RETURN PUMP (ChipBLASTER supplied) – INLET and OUTLET:

- 14.31.1. Check for leaks around the inlet and outlet connections.
- 14.31.2. If the hoses are cracked or cut replace hoses.

14.0. PREVENTATIVE MAINTENANCE: (Cont.):**14.34. LDENS SAMPLE LINE FILTER (Used with optional Auto Concentrate Monitor and Adjust) - CHANGING:****THIS CAN ONLY BE REPLACED WHEN THE CHIPBLASTER IS SHUT DOWN.**

The LDENS filter is not monitored because of the very low flow rate. The cartridge filter should be changed every 30 days under normal conditions. If there is a high volume of way oil (in the case of lathes) the filter should be changed more often. The tell tail signs of a dirty filter cartridge are:

- Erratic density readings (large fluctuations between readings).
- A large difference between the percent of concentrate read on a refractometer and the percentage shown on the HMI. If a large amount of way oil is present in the coolant a good refractometer reading may be difficult.

14.34.1. Power down ChipBLASTER unit.

14.34.2. Depress pressure release button to relieve pressure in filter housing.

14.34.3. Unscrew housing using spanner wrench.

NOTE: When opening filter housing to change cartridge, it is common for o- ring/Gasket to lift out of housing and stick to cap. Remove used cartridge and discard. Rinse out housing and fill about 1/3 full with clean premixed coolant.

NOTE: Make sure the o-ring is seated level in the groove (or gasket is on rim of sump).

CAUTION: If a ring gasket appears damaged or crimped it should be replaced at this time. Contact ChipBLASTER service for replacement parts.

14.34.4. Insert a new cartridge into the sump making sure that it slips down over the sump standpipe.

14.34.5. Screw the sump onto the cap and hand tighten. **DO NOT OVER-TIGHTEN.** Make sure cartridge slips over the cap standpipe.

14.34.6. Turn on power to the ChipBLASTER and energized a call for coolant. Allow the ChipBLASTER to run until the “DELAY BEFORE SAMPLE” timer in the PLC times out and a coolant sample is diverted through the filter. Check for any leaks. The ChipBLASTER may require several samples before the filter housing and sample line is purged of air.

14.37. EQUIPMENT COOLAING FANS - CLEANING:

14.37.1. To clean the equipment cooling fans, first power down the ChipBLASTER unit by turning off the main disconnect and locking it out.

14.37.2. Use a soft bristle brush to clean the fan blades. If dirt is caked on it may be necessary to remove the fan guard to clean, use a mild soap and water with stiff bristle brush to clean the fan blades. Be careful not to damage the fan blades. Replace the fan guards before returning the ChipBLASTER to service.



DO NOT USE COMPRESSED AIR TO CLEAN EQUIPMENT COOLING FANS.

15.0. TROUBLESHOOTING:**15.1. TROUBLESHOOTING CHART:**

FAULT	SYMPTOMS	CURE
Chipblaster Has No Power	Disconnect Switch Is Off	Turn On Main Power.
	Machine Tool Off	Turn On Disconnect.
		Turn On Machine Tool
	Overload Tripped	Correct Problem, Reset Overload
CR1 Or CR3 Not Energized	No Command Voltage From Machining Center	Check Command Voltage
	Faulty Relay	Replace Relay
High Pressure Motor Not Operating With "CALL FOR COOLANT" (CR1 And Or CR3) Energized	Faulty Transducer	Changes Transducer
	Faulty Solenoid	Change Solenoid
	CR1 Or CR7 Not Working	Check Circuits
	ES Relay De-Energized	Correct Problem And Press Reset/Air Purge Pushbutton.
High Pressure Motor Running Slow	CR8 Not Working	Check CR8 Circuit
	Faulty Transducer	Replace Transducer
	Faulty Solenoid (Sol A Or B)	Replace Solenoid
High Pressure Motor Running Fast	Nozzle To Large	Replace Nozzle
	Leak In Pressure Line	Repair Leak
	Faulty Transducer	Replace Transducer
	Faulty Solenoid	Replace Solenoid
	Faulty Unloader	Check Unloader
	Faulty AFD	Repair AFD
Cannot Achieve Required Outlet Pressure	Pump Seals Are Bad	Replace Seals
	Faulty Solenoid	Replace Solenoid
	Faulty Unloader	Check Unloader
	Incorrect Nozzle Size	Replace Nozzle With A Recommended Standard Size.
	Unloader Not Set Properly	Adjust Unloader
	Faulty AFD	Repair AFD
	Plugged Or Kinked Hose	Replace Coil

Fault	Systems	Cure
No Coolant Flowing When High Pressure Is Operating	Solenoid Valve Is Sticking	Replace Solenoid
	Solenoid Coil Is Faulty	Replace Coil
Coolant Is Pulsating From High Pressure Nozzle	High Pressure Pump Valve Is Sticking	Clean Or Replace The Valve
	Hose Plugged	Replace Hose
Coolant Continues To Flow During Tool Changes(Lathes Only)	CR3 Or CR4 Not Working	Check Circuit
	Solenoid (SOL A Or B) Sticking	Change Solenoid
Return Pump Not Operating	MR3 Motor Protector Tripped Or Not Turned On	Reset Breaker
		Turn On MR3
Return Pump Coolant Flow Rate Is Slow	Center Float Sticking	Free Up Float
	Plugged Inlet	Clean Inlet
	Low On Coolant	Add Coolant
	Chips Stuck Inside Pump Vane	Clean Chips From Inside Pump
	Motor Wired In Reverse	Change Motor Rotation
Coolant Is Foaming	Incorrect Coolant	Use Coolant With Anti-Foaming Agents For High Pressure
High Pressure Pump Shuts Down After 5 Seconds	Faulty Optional Low Pressure Detect Switch	Replace Low Pressure Detect Switch
	Seals Bad In High Pressure Pump	Change High Pressure Pump
		Check For Leaks And Repair
ES Relay Not Energized	Motor Overload Trip	Reset Motor Overload
	AFD Trip	Reset Power To AFD
	Low Limit Coolant	Add Coolant
	Circuit Breaker Trip	Reset Circuit Breaker
System Won't Operate	Loss Of 120VAC	Check Transformer, Reset 3CB And Or 4CB



BEFORE RESETTING AN AFD, CIRCUIT BREAKER OR MOTOR STARTER OVERLOAD – DETERMINE THE CAUSE AND CORRECT FIRST!



IF THE “ES” RELAY TURNS OFF, THE SYSTEM MUST BE RESET. AFTER THE ERROR IS CLEARED PRESS THE RESET / PURGE PUSHBUTTON ON THE ENCLOSURE DOOR.

FOR ADDITIONAL INFORMATION PLEASE CONTACT ChipBLASTER SERVICE DEPARTMENT AT (814) 724-6278.

WHEN CONTACTING ChipBLASTER SERVICE DEPARTMENT PLEASE HAVE MODEL AND SERIAL NUMBER OF YOUR ChipBLASTER UNIT.

15.2. TRANSDUCER VOLTAGE:

15.2.1. If calling we would like to know the transducer’s feedback voltage. The information displayed on the digital read-out of the AFD, (Motor Drive), and what the high pressure gauge reading is on the ChipBLASTER’s panel.

15.1

15.2.2. ALTIVAR 31 DRIVE

To check the Transducer’s feedback voltage, use your meter in the DC mode. Remove the drive control cover. Start the machine and place your **Neg** lead on The **COM** terminal. Place your **Pos** lead on the **AI2** terminal and record the reading.

NOTE: Electrical troubleshooting can be done over the phone if you have a qualified person.



USE EXTREME CAUTION WHEN WORKING INSIDE THE ELECTRICAL ENCLOSURE.

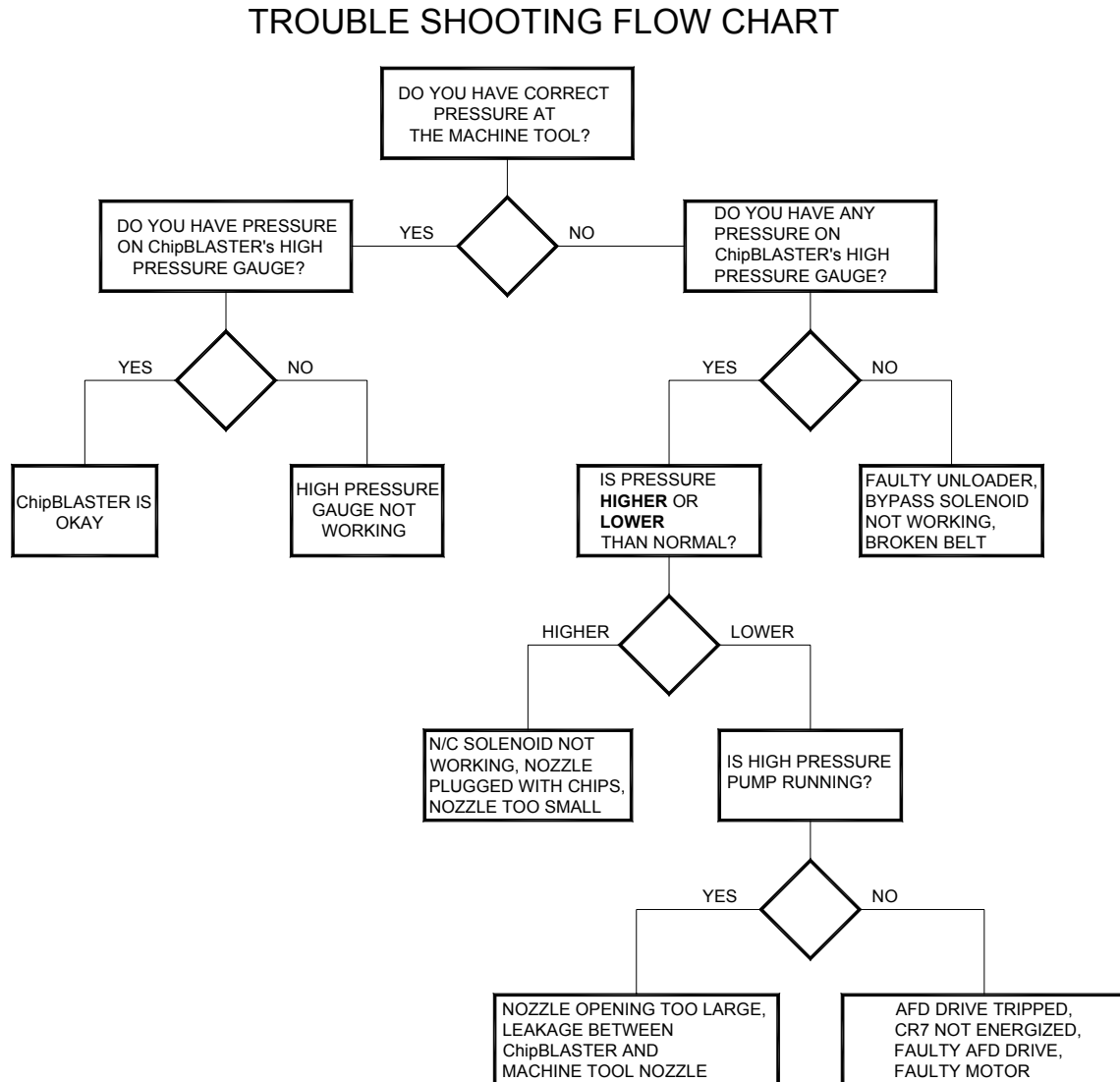
15.0. TROUBLESHOOTING (Cont.):**15.3. Troubleshooting Flow Chart**

Figure 7

15.0. TROUBLESHOOTING (Cont.):**15.4. ALTIVAR 31 DRIVE (1 AFD) ERROR CODES:**

**FOR DETAILED INFORMATION ON DRIVE AND / OR FAULTS
REFER TO THE SQUARE D ALTIVAR 31 MANUAL**

15.4.1. The drive controller can be unlocked after a fault by the following methods:

15.4.1.1. Removing power from the drive controller until the display clears.

15.4.1.2. Automatically, if the automatic restart function is enabled
(PARAMETER Atr IS SET TO YES, SEE PAGE 75 OF THE
Altivar31 PROGRAMMING MANUAL).

15.4.1.2. By a logic input, if a logic input is assigned to the fault reset
Function. (PARAMETER rSF ASSIGNED TO LI., (SEE PAGE 75 OF
THE Altivar31 PROGRAMMING MANUAL).



**DO NOT RESET THE INVERTER WHEN TRIPPED BECAUSE OF
A FAULT OR ERROR BEFORE ELIMINATING THE PROBLEM
THAT CAUSED THE FAULT OR TRIP.**

15.4.2 Faults which cannot be automatically reset:

15.4.2.1. Faults which cannot be automatically reset are listed in the table on next
page, to clear these faults:

15.4.2.2. Remove power from the drive controller.

15.4.2.3. Wait for the display to go off completely.

15.4.2.4. Determine the cause of the fault and correct it.

15.4.2.5. Reapply power.

bLF, CrF, OCF, SOF, AND tnF CAN ALSO BE RESET REMOTELY VIA A LOGIC
INPUT. REFER TO THE RSF PARAMETER ON PAGE 75 OF THE
PROGRAMMING MANUAL.

15.0. TROUBLESHOOTING (Cont.):**15.5. ALTIVAR 31 DRIVE (1 AFD) ERROR CODES (Cont.):****FAULTS WHICH CANNOT BE AUTOMATICALLY RESET**

Fault	Probable Cause	Remedy
<i>b L F</i> Brake sequence	Brake release current not reached	<ul style="list-style-type: none"> • Check the drive controller and motor connections. • Check the motor windings. • Check the lbr setting in the FUn-menu. Refer to page 68.
<i>E r F</i> Precharge circuit fault	Precharge circuit damaged	<ul style="list-style-type: none"> • Reset the drive controller. • Replace the drive controller.
<i>I n F</i> Internal fault	<ul style="list-style-type: none"> • Internal fault • Internal connection fault 	<ul style="list-style-type: none"> • Remove sources of electromagnetic interference. • Replace the drive controller.
<i>O C F</i> Overcurrent	<ul style="list-style-type: none"> • Incorrect parameter settings in the SEt- and drC- menus • Acceleration too rapid • Drive controller and/or motor undersized for load • Mechanical blockage 	<ul style="list-style-type: none"> • Check the SEt- and drC- parameters. • Ensure that the size of the motor and drive controller is sufficient for the load. • Clear the mechanical blockage.
<i>S C F</i> Motor short circuit	<ul style="list-style-type: none"> • Short circuit or grounding at the drive controller output • Significant ground leakage current at the drive controller output if several motors are connected in parallel 	<ul style="list-style-type: none"> • Check the cables connecting the drive controller to the motor, and check the motor insulation. • Reduce the switching frequency. • Connect output filters in series with the motor.
<i>S O F</i> Overspeed	<ul style="list-style-type: none"> • Instability • Overhauling load 	<ul style="list-style-type: none"> • Check the motor, gain, and stability parameters. • Add a braking resistor. • Check the size of the motor, drive controller, and load.
<i>t n F</i> Auto-tuning fault	<ul style="list-style-type: none"> • Motor or motor power not suitable for the drive controller • Motor not connected to the drive controller 	<ul style="list-style-type: none"> • Use the L or the P ratio (see UfT on page 27). • Check the presence of the motor during auto-tuning. • If a downstream contactor is being used, close it during auto-tuning.

15.5.1. Faults which can be automatically reset:

15.5.1.1. After the cause of the fault has been removed, the faults in the table listed on the next page can be reset.

15.5.1.2. With the automatic restart function. Refer to the “Atr” parameter in the FLT menu on page 75 of the programming manual.

15.5.1.3. Via a logic input. Refer to the “rSF” parameter in the FLt menu on page 75 of the programming manual.

15.5.1.4. By cycling power to the drive controller.

15.0. TROUBLESHOOTING (Cont.):**15.6. ALTIVAR 31 DRIVE (1 AFD) ERROR CODES (Cont.):****FAULTS WHICH CAN BE AUTOMATICALLY RESET**

Fault	Probable Cause	Remedy
C D F Serial link failure CANopen	Loss of communication between the drive controller and communication device or remote keypad.	<ul style="list-style-type: none"> Check the communication bus. Refer to the product-specific documentation.
E P F External fault	User defined	User defined
L F F Loss of 4-20 mA follower	Loss of the 4-20 mA reference on input AI3	Check the connection on input AI3.
O b F Overvoltage during deceleration	<ul style="list-style-type: none"> Braking too rapidly Overhauling load 	<ul style="list-style-type: none"> Increase the deceleration time. Install a braking resistor if necessary. Activate the brA function if it is compatible with the application. Refer to page 48.
O H F Drive overload	<ul style="list-style-type: none"> Drive controller or ambient temperature are too high. Continuous motor current load is too high. 	Check the motor load, the drive controller ventilation, and the environment. Wait for the drive controller to cool before restarting.
O L F Motor overload	<ul style="list-style-type: none"> Thermal trip due to prolonged motor overload Motor power rating too low for the application 	Check the lth setting (motor thermal protection, page 22), check the motor load. Allow the drive controller to cool before restarting.
O P F Motor phase failure	<ul style="list-style-type: none"> Loss of phase at drive controller output Downstream contactor open Motor not connected Instability in the motor current Drive controller oversized for motor 	<ul style="list-style-type: none"> Check the connections from the drive controller to the motor. If a downstream contactor is being used, set OPL to OAC. Refer to page 76. Test the drive controller on a low power motor or without a motor: set OPL to nO. Refer to page 76. Check and optimize the UFr (page 23), UnS (page 26), and nCr (page 26) parameters and perform auto-tuning (page 27).
O S F Overvoltage during steady state operation or during acceleration	<ul style="list-style-type: none"> Line voltage too high Line supply transients 	<ul style="list-style-type: none"> Check the line voltage. Compare with the drive controller nameplate rating. Reset the drive controller.
P H F Input phase failure	<ul style="list-style-type: none"> Input phase loss, blown fuse Three-phase drive controller used on a single phase line supply Input phase imbalance Transient phase fault <p><i>NOTE: This protection only operates with the drive controller running under load.</i></p>	<ul style="list-style-type: none"> Check the connections and the fuses. Disable the fault by setting IPL to nO. Refer to page 76. Verify that the input power is correct. Supply three-phase power if needed.
S L F Serial link failure Modbus	Loss of connection between the drive controller and the communication device or the remote keypad display.	<ul style="list-style-type: none"> Check the communication connection. Refer to the product-specific documentation.

15.0. TROUBLESHOOTING (Cont.):**15.7. ALTIVAR 31 DRIVE (1 AFD) ERROR CODES (Cont.):****FAULTS THAT RESET WHEN THE FAULT IS CLEARED**

Fault	Probable Cause	Remedy
<i>E F F</i> Configuration fault	The parameter configurations are not suited to the application.	Restore the factory settings or load the backup configuration, if it is valid. See parameter FCS in the drC- menu, page 31.
<i>E F I</i> Configuration fault via serial link	The parameter configurations loaded in the drive controller via the serial link are not suited to the application.	<ul style="list-style-type: none"> • Check the configuration loaded previously. • Load a compatible configuration.
<i>U S F</i> Undervoltage	<ul style="list-style-type: none"> • Line supply too low • Transient voltage dip • Damaged precharge resistor 	<ul style="list-style-type: none"> • Check the line voltage. • Check the setting of the UNS parameter. See page 26. • Replace the drive controller.



TURNING THE INVERTER POWER OFF AND THEN ON AGAIN RESETS THE INVERTER IMMEDIATELY. THIS OPERATION MAY DAMAGE THE SYSTEM OR THE MOTOR IF REPEATED.

15.0. TROUBLESHOOTING (Cont.):**15.8. ALTIVAR 31 DRIVE AS SET PARAMETERS 230 VAC W/ and W/O PRESETS:**

Code	Label	Value	Default value	Logical address	Menu
ACC	Acceleration ramp time	1.0 s ALL MODELS	3.0 s	9001	
ADC	Automatic DC Injection	Yes: DC inj. for adj. time	Yes: DC inj. for adj. time	10401	
ADCO	Drive CANopen address	0	0	6051	
AI1A	Configuration of AI1	Not configured ALL MODELS	Configuration reference 1	4821	
AI2A	Configuration of AI2	Configuration reference 1 PI regulator feedback ALL MODELS	Summing input 2	4822	
AI3A	Configuration of AI3	Not configured	Not configured	4823	
AO1T	Configuration of AO1	Configuration 0 - 20 mA	Configuration 0 - 20 mA	4601	
ATR	Automatic restart	No	No	7122	
BDCO	CANopen trans. speed	125 kbit/s	125 kbit/s	6053	
BFR	Std. motor frequency	60Hz ALL MODELS	50 Hz	3015	
BLC	Brake control	Not assigned	Not assigned	10001	
BRA	Decel ramp adaptation	Yes	Yes	9003	
CHP	Switching, motor 2	Not assigned	Not assigned	8011	
CLI	Internal current limit	41.2A	41.2A	9201	
COL	Stop for CANopen fit. COF	Freewheel	Freewheel	7011	
cas	Motor power factor	0.85	0.85	9606	
CRH3	Value for high speed AI3	20.0 mA	20.0 mA	4444	
CRL3	Value for low speed AI3	4.0mA	4.0mA	4434	
CTD	Motor current detection	27.5 A	27.5 A	11001	
DCI	DC brake via logic input	Not assigned	Not assigned	11203	
DEC	Deceleration ramp time	0.5 s ALL MODELS	3.0 s	9002	
DO	AOC/AOV assignment	Not assigned	Not assigned	5031	
DRN	Derating for undervoltage	No	No	7007	
EPL	Stop mode at external fit.	Freewheel	Freewheel	7006	
ERCO	Error registry CANopen	0	0	6056	
ETF	External fault	Not assigned	Not assigned	7131	
FBS	PI multiplication coef.	1.0	1.0	11903	
FLG	Frequency loop gain	20%	20%	9620	
FLO	Forced local mode	Not assigned	Not assigned	8431	
FLR	Catch on fly	No	No	3110	
FR1	Configuration reference 1	Analog input AI2 ALL MODELS	Analog input AI1	8413	
FR2	Configuration reference 2	Not configured	Not configured	8414	
FRS	Nominal motor frequency	60.0 Hz	60.0 Hz	9602	
FRT	Ramp 2 switch frequency	0.0 Hz	0.0 Hz	9011	
FST	Fast stop	Not assigned	Not assigned	11204	
FTD	Motor freq. threshold	60.0 Hz	60.0 Hz	11003	
HSP	High Speed	68.0 Hz JV4 & 8, 75.0 Hz EV 80.0 Hz GV & CV	60.0 Hz	3104	

15.0. TROUBLESHOOTING (Cont.):**15.8. ALTIVAR 31 DRIVE AS SET PARAMETERS 230 VAC W/ and W/O PRESETS (Cont.):**

Code	Label	Value	Default value	Logical address	Menu
INH	Fault inhibit	Not assigned	Not assigned	7125	
IPL	loss of input phase	Yes	Yes	7002	
ITH	Motor Thermal Current	JV4 12.6 A, JV8 19.1 A, EV 25.5 A, GV20 42 A	27.5 A	9622	
JF2	Skip frequency 2	0.0 Hz	0.0 Hz	11302	
JOG	Jog operation	Not assigned	Not assigned	11110	
JPF	Skip frequency	0.0 Hz	0.0 Hz	11301	
LAC	Function access level	Access to std. functions	Access to std. functions	3006	
IAF	Limit, forward direction	Not assigned	Not assigned	11601	
LAR	Limit, reverse direction	Not assigned	Not assigned	11602	
LC2	Enable current limit 2	Not assigned	Not assigned	9202	
LCC	Remote terminal control	No	No	64003	
IFF	Fall back speed	10.0 Hz	10.0 Hz	7080	
LFL	Stop mode at loss 4-20mA	Fault ignored	Fault ignored	7003	
LI1A	Config. logic input 1	Forward ALL UNITS	Forward	4801	
LI2A	Config. logic input 2	Select 2 preset PI refs. ALL UNITS	Reverse	4802	
LI3A	Config. logic input 3	Select 4 preset PI refs. ALL UNITS	Select 2 preset speeds	4803	
LI4A	Config. logic input 4	Not configured	Select 4 preset speeds	4804	
LI5A	Config. logic input 5	Not configured	Not configured	4805	
LI6A	Config. logic input 6	Not configured	Not configured	4806	
LSP	Low Speed	JV4 & 8 15.0 Hz EV, GV, CV 10.0 Hz	0.0 Hz	3105	
NCR	Nominal motor current	JV4 12.6 A, JV8 19.1 A, EV 25.5 A, GV20 42 A	22.0A	9603	
NRD	Motor Noise Reduction	Yes	Yes	3107	
NSP	Nominal motor speed	1780 rpm ALL MODELS	1780 rpm	9604	
NST	Freewheel stop	Not assigned	Not assigned	11202	
OHI	Stop mode at drive oheat	Freewheel	Freewheel	7008	
all	Stop mode at motor oheat	Freewheel	Freewheel	7009	
OPI	Output Phase loss	OPF fault	OPF fault	9611	
PIC	PI inversion	No	No	11940	
PIF	PI regulator feedback	Analog input AI2 ALL MODELS	Not configured	11901	
PII	Internal reference PI	Yes ALL MODELS	No	11908	
PR2	Enable 2 preset PI refs	logic input LI2 ALL MODELS	Not assigned	11909	
PR4	Enable 4 preset PI refs	Logic input LI3 ALL MODELS	Not assigned	11910	
PS16	Enable 16 preset speeds	Not assigned	Not assigned	11404	
PS2	Enable 2 preset speeds	Not assigned ALL MODELS	Logic input LI3	11401	
PS4	Enable 4 preset speeds	Not assigned ALL MODELS	Logic input LI4	11402	
PS8	Enable 8 preset speeds	Not assigned	Not assigned	11403	
PST	STOP Key Priority	Yes	Yes	64002	

15.0. TROUBLESHOOTING (Cont.):**15.8. ALTIVAR 31 DRIVE AS SET PARAMETERS 230 VAC W/ and W/O PRESETS (Cont.):**

Code	Label	Value	Default value	logical address	Menu
R1	Relay R1	Drive fault	Drive fault	5001	
R2	Relay R2	Not assigned	Not assigned	5002	
RFC	Enable switching refs.	Configuration reference 1	Configuration reference 1	8411	
RIG	Integral gain PI regulator	3.75 ALL MODELS	1.00	11942	
RP2	2nd PI preset reference	36.0% ALL MODELS	30.0%	11921	
RP3	3rd PI preset reference	24.0% ALL MODELS	60.0%	11922	
RP4	4th PI preset reference	10.0 % ALL MODELS	90.0%	11923	
RPG	PI Proportional gain	1.50	1.00	11941	
RPI	Internal PI reference	45.0%	0.0%	11920	
RPS	Ramp switching	Not assigned	Not assigned	9010	
RPT	Type of Ramp	U-Ramp ALL MODELS	Linear ramp	9004	
RRS	Reverse	Not assigned ALL MODELS	Logic input LI2	11105	
RSC	Cold stator resistance	Inactiv.	Inactiv.	9643	
RSF	Fault reset	Not assigned	Not assigned	7124	
SA2	Summing input 2	Not configured ALL MODELS	Analog input AI2	11801	
SA3	Summing input 3	Not configured	Not configured	11802	
SDC1	DC current at standstill	19.2A	19.2A	10403	
SDC2	DC current at standstill 2	13.7 A ALL MODELS	9.5A	10405	
SDS	Display scale factor	30.0	30.0	12001	
SFR	Drive switching frequency	4.0 kHz	4.0 kHz	3102	
SLL	Stop mode at Modbus SLF	Freewheel	Freewheel	7010	
SLP	Slip Compensation	100%	100 %	9625	
SRF	Disable speed loop filter	No	No	9101	
STA	Frequency loop stability	20%	20%	9621	
SIP	Ctrl'd stop on power loss	Lock drive freewheel stop	Lock drive freewheel stop	7004	
sn	Normal stop mode	On ramp	On ramp	11201	
TCC	2 wire or 3 wire control	2-wire control	2-wire control	11101	
TCT	Type of 2 wire control	Edge triggered	Edge triggered	11102	
TDC1	DC injection time	0.5 s	0.5's	10402	
TDC2	2nd DC injection time	0.0 s	0.0 s	10404	
TFR	Max. output frequency	JV4 & 8 68.0 Hz, EV 75.0 Hz GV & CV 80.0 Hz	72.0 Hz	3103	
TLS	Low speed time out	0.0s	0.0 s	11701	
TNL	Auto-tuning fault config.	Yes	Yes	7012	
nD	Motor thermal threshold	100%	100 %	11002	
TUN	Automatic tuning	Not assigned	Not assigned	9608	
UFR	Voltage boost	20%	20%	9623	
UFT	Select type of U/F ratio	Sensorless flux vector ctrl	Sensorless flux vector ctrl	9607	
NS	Nominal motor voltage	240 V All MODELS	230V	9601	

15.0. TROUBLESHOOTING (Cont.):**15.9. ALTIVAR 31 DRIVE AS SET PARAMETERS 460 VAC W/ and W/O PRESETS:**

Code	Label	Value	Default value	Logical address	Menu
ACC	Acceleration ramp time	1.0 s ALL MODELS	3.0 s	9001	
ADC	Automatic DC Injection	Yes: DC inj. for adj. time	Yes: DC inj. for adj. time	10401	
ADCO	Drive CANopen address	0	0	6051	
AI1A	Configuration of AI1	Not configured ALL MODELS	Configuration reference 1	4821	
AI2A	Configuration of AI2	Configuration reference 1 PI ALL MODELS	Summing input 2	4822	
		regulator feedback			
AI3A	Configuration of AI3	Not configured	Not configured	4823	
AO1T	Configuration of AO1	Configuration 0 - 20 mA	Configuration 0 - 20 mA	4601	
ATR	Automatic restart	No	No	7122	
BDCO	CANopen trans. speed	125 kbit/s	125 kbit/s	6053	
BFR	Std. motor frequency	60Hz ALL MODELS	50 Hz	3015	
BLC	Brake control	Not assigned	Not assigned	10001	
BRA	Decel ramp adaptation	Yes	Yes	9003	
CHP	Switching, motor 2	Not assigned	Not assigned	8011	
CLI	Internal current limit	41.2A	41.2A	9201	
COL	Stop for CANopen fit. COF	Freewheel	Freewheel	7011	
cas	Motor power factor	0.85	0.85	9606	
CRH3	Value for high speed AI3	20.0 mA	20.0 mA	4444	
CRL3	Value for low speed AI3	4.0mA	4.0mA	4434	
CTD	Motor current detection	27.5 A	27.5 A	11001	
DCI	DC brake via logic input	Not assigned	Not assigned	11203	
DEC	Deceleration ramp time	0.5 s ALL MODELS	3.0 s	9002	
DO	AOC/AOV assignment	Not assigned	Not assigned	5031	
DRN	Derating for undervoltage	No	No	7007	
EPL	Stop mode at external fit.	Freewheel	Freewheel	7006	
ERCO	Error registry CANopen	0	0	6056	
ETF	External fault	Not assigned	Not assigned	7131	
FBS	PI multiplication coef.	1.0	1.0	11903	
FLG	Frequency loop gain	20%	20%	9620	
FLO	Forced local mode	Not assigned	Not assigned	8431	
FLR	Catch on fly	No	No	3110	
FR1	Configuration reference 1	Analog input AI2 ALL MODELS	Analog input AI1	8413	
FR2	Configuration reference 2	Not configured	Not configured	8414	
FRS	Nominal motor frequency	60.0 Hz	60.0 Hz	9602	
FRT	Ramp 2 switch frequency	0.0 Hz	0.0 Hz	9011	
FST	Fast stop	Not assigned	Not assigned	11204	
FTD	Motor freq. threshold	60.0 Hz	60.0 Hz	11003	
HSP	High Speed	68.0 Hz JV4 & 8, 75.0 Hz EV 80.0 Hz GV & CV	60.0 Hz	3104	

15.0. TROUBLESHOOTING (Cont.):**15.9. ALTIVAR 31 DRIVE AS SET PARAMETERS 460 VAC W/ and W/O PRESETS (Cont.):**

Code	Label	Value	Default value	Logical address	Menu
INH	Fault inhibit	Not assigned	Not assigned	7125	
IPL	loss of input phase	Yes	Yes	7002	
ITH	Motor Thermal Current	JV4 12.6 A, JV8 19.1 A, EV 25.5 A, GV20 42 A	27.5 A	9622	
JF2	Skip frequency 2	0.0 Hz	0.0 Hz	11302	
JOG	Jog operation	Not assigned	Not assigned	11110	
JPF	Skip frequency	0.0 Hz	0.0 Hz	11301	
LAC	Function access level	Access to std. functions	Access to std. functions	3006	
IAF	Limit, forward direction	Not assigned	Not assigned	11601	
LAR	Limit, reverse direction	Not assigned	Not assigned	11602	
LC2	Enable current limit 2	Not assigned	Not assigned	9202	
LCC	Remote terminal control	No	No	64003	
IFF	Fall back speed	10.0 Hz	10.0 Hz	7080	
LFL	Stop mode at loss 4-20mA	Fault ignored	Fault ignored	7003	
LI1A	Config. logic input 1	Forward ALL UNITS	Forward	4801	
LI2A	Config. logic input 2	Select 2 preset PI refs. ALL UNITS	Reverse	4802	
LI3A	Config. logic input 3	Select 4 preset PI refs. ALL UNITS	Select 2 preset speeds	4803	
LI4A	Config. logic input 4	Not configured	Select 4 preset speeds	4804	
LI5A	Config. logic input 5	Not configured	Not configured	4805	
LI6A	Config. logic input 6	Not configured	Not configured	4806	
LSP	Low Speed	JV4 & 8 15.0 Hz EV, GV, CV 10.0 Hz	0.0 Hz	3105	
NCR	Nominal motor current	JV4 12.6 A, JV8 19.1 A, EV 25.5 A, GV20 42 A	22.0A	9603	
NRD	Motor Noise Reduction	Yes	Yes	3107	
NSP	Nominal motor speed	1780 rpm ALL MODELS	1780 rpm	9604	
NST	Freewheel stop	Not assigned	Not assigned	11202	
OHI	Stop mode at drive oheat	Freewheel	Freewheel	7008	
all	Stop mode at motor oheat	Freewheel	Freewheel	7009	
OPI	Output Phase loss	OPF fault	OPF fault	9611	
PIC	PI inversion	No	No	11940	
PIF	PI regulator feedback	Analog input AI2 ALL MODELS	Not configured	11901	
PII	Internal reference PI	Yes ALL MODELS	No	11908	
PR2	Enable 2 preset PI refs	logic input LI2 ALL MODELS	Not assigned	11909	
PR4	Enable 4 preset PI refs	Logic input LI3 ALL MODELS	Not assigned	11910	
PS16	Enable 16 preset speeds	Not assigned	Not assigned	11404	
PS2	Enable 2 preset speeds	Not assigned ALL MODELS	Logic input LI3	11401	
PS4	Enable 4 preset speeds	Not assigned ALL MODELS	Logic input LI4	11402	
PS8	Enable 8 preset speeds	Not assigned	Not assigned	11403	
PST	STOP Key Priority	Yes	Yes	64002	

15.0. TROUBLESHOOTING (Cont.):**15.9. ALTIVAR 31 DRIVE AS SET PARAMETERS 460 VAC W/ and W/O PRESETS (Cont.):**

Code	Label	Value	Default value	logical address	Menu
R1	Relay R1	Drive fault	Drive fault	5001	
R2	Relay R2	Not assigned	Not assigned	5002	
RFC	Enable switching refs.	Configuration reference 1	Configuration reference 1	8411	
RIG	Integral gain PI regulator	3.75 ALL MODELS	1.00	11942	
RP2	2nd PI preset reference	36.0% ALL MODELS	30.0%	11921	
RP3	3rd PI preset reference	24.0% ALL MODELS	60.0%	11922	
RP4	4th PI preset reference	10.0 % ALL MODELS	90.0%	11923	
RPG	PI Proportional gain	1.50	1.00	11941	
RPI	Internal PI reference	45.0%	0.0%	11920	
RPS	Ramp switching	Not assigned	Not assigned	9010	
RPT	Type of Ramp	U-Ramp ALL MODELS	Linear ramp	9004	
RRS	Reverse	Not assigned ALL MODELS	Logic input LI2	11105	
RSC	Cold stator resistance	Inactiv.	Inactiv.	9643	
RSF	Fault reset	Not assigned	Not assigned	7124	
SA2	Summing input 2	Not configured ALL MODELS	Analog input AI2	11801	
SA3	Summing input 3	Not configured	Not configured	11802	
SDC1	DC current at standstill	19.2A	19.2A	10403	
SDC2	DC current at standstill 2	9.5A ALL MODELS	9.5A	10405	
SDS	Display scale factor	30.0	30.0	12001	
SFR	Drive switching frequency	4.0 kHz	4.0 kHz	3102	
SLL	Stop mode at Modbus SLF	Freewheel	Freewheel	7010	
SLP	Slip Compensation	100%	100 %	9625	
SRF	Disable speed loop filter	No	No	9101	
STA	Frequency loop stability	20%	20%	9621	
SIP	Ctrld stop on power loss	Lock drive freewheel stop	Lock drive freewheel stop	7004	
sn	Normal stop mode	On ramp	On ramp	11201	
TCC	2 wire or 3 wire control	2-wire control	2-wire control	11101	
TCT	Type of 2 wire control	Edge triggered	Edge triggered	11102	
TDC1	DC injection time	0.5 s	0.5"s	10402	
TDC2	2nd DC injection time	0.0 s	0.0 s	10404	
TFR	Max. output frequency	JV4 & 8 68.0 Hz, EV 75.0 Hz GV & CV 80.0 Hz	72.0 Hz	3103	
TLS	Low speed time out	0.0s	0.0 s	11701	
TNL	Auto-tuning fault config.	Yes	Yes	7012	
nD	Motor thermal threshold	100%	100 %	11002	
TUN	Automatic tuning	Not assigned	Not assigned	9608	
UFR	Voltage boost	20%	20%	9623	
UFT	Select type of U/F ratio	Sensorless flux vector ctrl	Sensorless flux vector ctrl	9607	
UNS	Nominal motor voltage	460 V ALL MODELS	460V	9601	

16.0. PRESSURE ADJUSTMENT PROCEDURE ALTIVAR 31 DRIVES:

This procedure is to be used to adjust the output pressure of the ChipBLASTER high-pressure unit. **Please be aware that you must have working knowledge of the complete ChipBLASTER system before making any pressure adjustments.** All ChipBLASTER units are shipped out of the factory pre-set at a working pressure of 1000 psi, (68.9 Bar) unless otherwise specified by the end user. This pressure can be read from the high pressure gauge located on the side of the ChipBLASTER unit.

Check the machine tool specifications for a maximum operating pressure before proceeding with this procedure.



DO NOT EXCEED THE MANUFACTURERS MAXIMUM OPERATING PRESSURE.

Procedure:

- 16.0.1. Shut off power to the ChipBLASTER unit.
- 16.0.2. Locate the Coolant Manifold Assembly under the ChipBLASTER's coolant tank.
This Manifold Assembly will need to be accessible during this procedure for achieving settings over 1000 psi (68.9 Bar).
- 16.0.3. Locate coolant outlet #1 (SOL A), and coolant outlet #2 (SOL B), disconnect the solenoid din connector from each solenoid coil.
- 16.0.4. Repower the ChipBLASTER unit.



USE EXTREME CAUTION WHEN WORKING ON LIVE EQUIPMENT.

- 16.0.5. Energize call for coolant on the machining center.
- 16.0.6. Locate and adjust the high-pressure unloader using the high-pressure gauge to view the pressure setting. Set the high-pressure unloader **200-psi** (13.7 Bar) over the desired working pressure. After the correct adjustment has been made, tighten the lock nut to secure the setting.

TURNING THE UNLOADER ADJUSTMENT ROD (CLOCKWISE) INCREASES THE PRESSURE SETTING OF THE UNLOADER.

TURNING THE UNLOADER ADJUSTMENT ROD (COUNTER-CLOCKWISE) DECREASES THE PRESSURE SETTING OF THE UNLOADER.

- 16.0.7 Turn off high-pressure coolant and power down the ChipBLASTER unit.
- 16.0.8. Locate coolant outlet #1 (SOL A), and coolant outlet#2 (SOL B), re-connect the solenoid din connector from each solenoid coil.
- 16.0.9. Open the enclosure door and locate the adjustable frequency drive (located in the lower left corner of the enclosure).

16.0. PRESSURE ADJUSTMENT PROCEDURE ALTIVAR 31 DRIVES: (Cont.)

16.0.10. Turn the main disconnect on to repower the ChipBLASTER unit to alter the program pressure setting changes to the AFD (Adjustable Frequency Drive).



USE EXTREME CAUTION WHEN WORKING ON LIVE EQUIPMENT.

16.0.11. **FOR ALTIVAR 31 DRIVES** without setpoints - Adjust the PID setpoint as follows:

16.0.11.1. At the **rdY** promp on the display PRESS **ENT**. **SEt** will be displayed.

16.0.11.2. Press **ENT**. **rPI** will be displayed.

16.0.11.3. Press **ENT**, 50.0 will be displayed.

16.0.11.4. Press the **up** or **down arrow** keys as required to change hertz setting of the drive. Decreasing the hertz setting will reduce the output pressure like wise increasing the hertz setting will increase the output pressure. **Do not exceed the maximum pressure rating of the machine tool.**

16.0.11.5. When the revised pressure setting is reached (indicated on the high pressure gauge) PRESS **ENT**.

16.0.11.6. PRESS **ESC** three times to return to the **rdy** screen.

NOTE:

-Lowering the setpoint will decrease the output pressure.

-Raising the setpoint will increase the output pressure.

To view the load on the motor:

With display showing **rdY**.

Press **ENT** display will show **Set**.

Press the "**DOWN**" arrow three times until **SUP** is displayed.

Display will show **FrH**.

Press the "**DOWN**" arrow key four times until **LCr** is displayed.

This will display the motor current in amps.

To return to the **rdY** display press **ESC**.

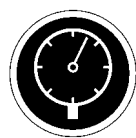


DO NOT PRESS ENT.

16.0.11.7. Test run the machine and check the output pressure on the high - pressure gauge and make the necessary adjustments to achieve the desired working pressure.

**16.0. PRESSURE ADJUSTMENT PROCEDURE ALTIVAR 31
DRIVES: (Cont.)**

If you cannot achieve the desired output pressure, please check to be sure that the unloader has been properly set. Also refer to the orifice reference charts (SECTION 28) included to verify nozzle size to make sure you are within the machine’s capabilities.



MODEL	ORIFICE SIZE	FLOW	PRESSURE
EV13, EVHP	0.110” (2.9 mm)	13.8 GPM 52.2/m	1000 PSIG (68.9 bar)

17.0. HIGH PRESSURE PUMP REPLACEMENT (SINGLE PUMP):



IT IS EXTREMELY IMPORTANT TO DISCONNECT AND LOCKOUT ANY AND ALL POWER SOURCES BEFORE ANY WORK IS TO BE PERFORMED ON THE ChipBLASTER UNIT!

17.1. LUBRICATION



17.1.2. After pump replacement procedure, check to insure that the replacement pump crankcase contains oil, and is at the proper level.

Use synthetic *Mobil One 15w-50* oil only.

Refer to SECTION 14.3.2. for oil filling instructions.

17.2. HYDRAULIC CONNECTIONS AND DRIVE BELT REMOVAL:

17.2.1. Loosen the four mounting bolts, located on the high pressure pump, to allow for high pressure pump adjustment or drive belt removal. To remove the drive belt, release the belt tension by advancing the high pressure pump forward. Turning the high pressure pump mount adjustment idler counter-clockwise will advance the high pressure pump forward, towards the driven pulley.

17.2.2. Tools required for pump replacement:

17.2.2.1. Pump mounting bolts – 9/16” wrench.

17.2.2.2. Pump mount adjustment idler – 9/16” wrench.

17.2.2.3. Motor drive pulley – 7/16” wrench.

17.2.2.4. JV10, JVHP, GV20, GVHP high pressure fittings – 7/8” wrench.

17.2.2.5. EV13, EVHP high pressure fittings – 1 1/8” wrench.

17.2.2.6. JV10, JVHP, EV13, EVHP, GV20, GVHP low pressure fittings – pipe wrench.

17.2.2.7. Pump bracket bolts – 5/16” hex key.



DO NOT PRY OR FORCE THE DRIVE BELT OFF OF THE PULLEYS, THIS MAY RESULT IN PERMANENT DAMAGE TO THE PULLEY OR BELT.



ONCE THE DRIVE BELT HAS BEEN REMOVED, VISUALLY INSPECT IT FOR ABNORMAL WEAR AND TOOTH SHEAR. REPLACE THE BELT AS NECESSARY.

17.0. HIGH PRESSURE PUMP REPLACEMENT (SINGLE PUMP):**(Cont.):****17.3. THE REPLACEMENT PUMP:**

- 17.3.1. Remove the low pressure hose, high pressure hose, oil line hose, black drain line lines and the pulley from the defective pump. Remove the 4 bolts that secure the pump to the rails and remove the defective pump.
- 17.3.2. Install the replacement pump on the rails using the hardware removed in step 17.3.1. above.
- 17.3.3. Install the pulley (DO NOT TIGHTEN), low pressure hose, high pressure hose, oil line hose, black drain line on the replacement pump. NOTE: The upper port is the high pressure port and the lower port is the low pressure port.
- 17.3.4. Torque all of the hex and square plumbing fittings to 36ft/lbs. (48.8 Nm).
Using a straightedge to line up the pulleys on the pump and motor. Tighten pulley set screws.
- 17.3.5. Torque bushing bolts to 108 in lb (12.2 Nm).

18.0. BELT INSTALLATION:

18.1. ALIGN SPROCKETS:

18.1.1. Sprocket alignment and parallelism of the shafts is very important. Proper alignment helps to equalize the load across the entire belt width, thereby reducing wear and extending belt life. The sketches below show how to align a Synchronous drive properly. PLACE A STRAIGHTEDGE against the outside edge of the sprockets as shown in Figure 11; Figure 12 shows the four points where the straightedge should touch the sprockets.

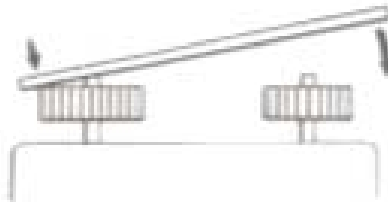


Figure 11

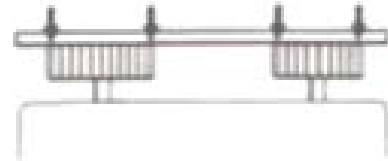


Figure 12

18.1.2. The straightedge should cross the sprockets at the widest possible part. (See Figure 13.) OR USE A STRING. Tie a string around either shaft (Figure 14) and pull it around and across the outer edge of both sprockets. Figure 15 shows how the string should touch four points when the drive is properly aligned. After aligning the sprockets, check the rigidity of the supporting framework. Shafts should be well supported to prevent distortion and a resulting change in the center distance under load. Do not use spring-loaded or weighted idlers. Idler sprockets or pulleys must be locked into position after adjusting belt tension. Please note: At least one sprocket must have a flange.

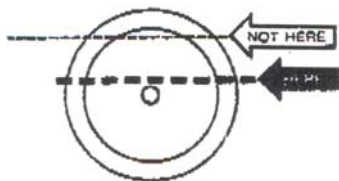


Figure 13

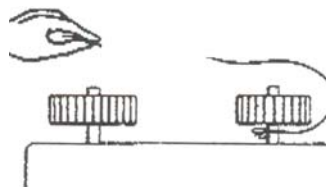


Figure 14

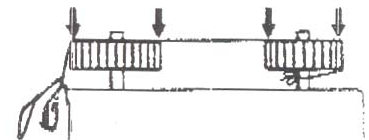


Figure 15

18.2. INSTALL BELT:

18.2.1. Do not pry or otherwise force the belt onto the sprockets, as this can result in permanent damage to the belt. Either remove the sprocket's outside flange or reduce the center distance between the sprockets so that the belt can be easily installed.

18.3. BELT TENSIONING - GENERAL METHOD:

18.3.1. This method of tensioning Synchronous belts should satisfy most drive requirements.

18.3.1.1. Reduce the center distance so that the belt can be placed onto the sprockets without forcing or prying it over the flanges.

18.0. BELT INSTALLATION (Cont.):

- 18.3.1.2. Increase the belt tension until the belt feels snug or taut. Avoid over tensing the belt.
- 18.3.1.3. Start the drive and apply the most severe load condition. This may be either the motor starting torque or during the work cycle. A belt that is too loose will "jump teeth" under the most severe load condition. When this occurs, gradually increase the belt tension until satisfactory operation is achieved.

18.4. BELT TENSIONING - FORCE DEFLECTION METHOD:

- 18.4.1. An alternate numerical method can also be used to properly tension the belt on a Synchronous drive. This procedure, commonly referred to as the Force Deflection Method, consists of measuring the pounds of force required to deflect the belt a given amount.
 - 18.4.1.1. Install the belt as per Steps 1 and 2 of the General Method. Measure the span length (in inches) as illustrated in Figure 11.
 - 18.4.1.2. From Figure 11 determine the deflection height required for the drive. The deflection height is always $1/64$ " per inch of span length. For example, a 32" span length requires a deflection of $32/64$ " or $1/2$ ". To measure the deflection height place a straightedge from sprocket to sprocket on top of the belt or wrap a string or steel tape around the sprockets on top of the belt. This will serve as a reference line to measure deflection inches.
 - 18.4.1.3. Using the formula at below, calculate the minimum and maximum force values (lbs.).
 - 18.4.1.4. Using a spring scale, apply a perpendicular force to the belt at the mid-point of the span as illustrated in Figure 1. NOTE: For belts wider than 2 inches, it is suggested that a rigid piece of key stock or something similar be placed across the belt between the point of force and the belt to prevent belt distortion. Compare this deflection force value to that found in 18.4.1.4. Adjust belt tension accordingly.

Actual belt installation tension required depends on peak loads, system rigidity, teeth in mesh, etc. In some instances it may be necessary to gradually increase the belt tension to achieve proper operation of the drive.

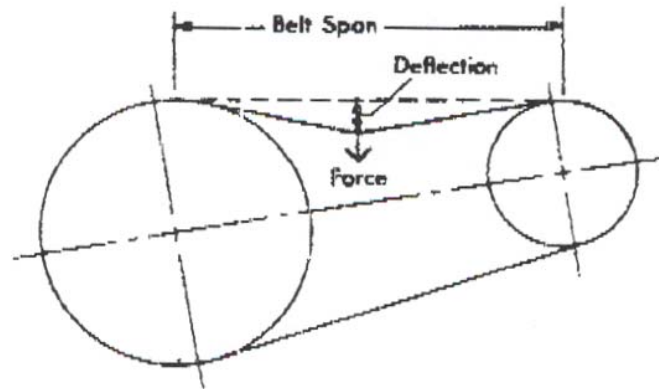
18.0. BELT INSTALLATION (Cont.):

Figure 16

$$\text{Maximum Force} = \frac{4000 \times \text{DHP}}{\text{RPM} \times \text{Pitch Diameter}}$$

$$\text{Minimum Force} = \frac{5000 \times \text{BHP}}{\text{RPM} \times \text{Pitch Diameter}}$$

DHP = Belt Horsepower or Motor Horsepower x Recommended Service Factor

BHP = Brake Horsepower Or Motor Horsepower

RPM = Speed of Fastest Shaft

Pitch Diameter = Diameter of Smallest Sprocket



REINSTALL ALL (GUARDS) PROTECTIVE PANELING ON THE ChipBLASTER UNIT.

18.5. EV, EVHP BELT TIGHTENING CHART:

MODEL	DEFLECTION INCHES (DECIMAL)	DEFLECTION INCHES NEAREST (FRACTION)	DEFLECTION MILLIMETERS	POUNDS OF FORCE	KILOGRAMS OF FORCE
EV13	0.084	3/32"	2.15	8.86	4.02

19.0. SYSTEM CONTAMINATION PURGING PROCEDURE:

- 19.1. Tools Required:
 - 19.1.1. 6mm Hex Head Wrench
 - 19.1.2. 7/8" Wrench (For Unit Without Pressure Switch Option)
 - 19.1.3. 1-1/4" Wrench (For Unit With Pressure Switch Option)
 - 19.1.4. 5 Gallon Fluid Container
 - 19.1.5. Section of Low Pressure Hose
 - 19.1.6. Adapter Fitting (1/2" SAE to Hose Connection)
 - 19.1.7. Small Phillips Screw Driver (For Unit With Pressure Switch Option)
- 19.2. Change Filter Bag:
 - 19.2.1. Shut off all power to machine.
 - 19.2.2. Open the Air Bleeder Valves located on the upper portion of the filter and on post filter to release any pressure on filter housing.
 - 19.2.3 Visually check filter inlet and outlet pressure gauges for zero pressure.



**IF THERE IS PRESSURE PRESENT DO NOT OPEN FILTER HOUSING
SEEK ASSISTANCE FROM QUALIFIED MAINTENANCE
PERSONNEL TO RELIEVE PRESSURE.**

- 19.2.4. Remove Filter Housing Lid.
- 19.2.5. Remove and inspect the "O-ring.
- 19.2.6. Remove Filter Displacement Device or Optional Hydrocyclonic Filter.
- 19.2.7. Remove and discard old filter.



**DO NOT POUR REMAINING COOLANT FROM FILTER BAG BACK IN
THE VESSEL OR CONTAMINATES WILL ENTER THE SYSTEM.**

- 19.2.8 Replace with a new filter bag, making sure that it is seated firmly against the top of the Filter Basket.
 - 19.2.9 Replace Filter Displacement Device or Optional Hydrocyclonic Filter.
 - 19.2.10 Fill filter housing with coolant.
 - 19.2.11 Replace the "O-ring, making sure it is properly seated in the rim of the Filter Body.
 - 19.2.10 Replace the lid, being careful not to displace "O-ring.
 - 19.2.11 Torque all Filter Lid fasteners to 360-480 in-lbs.(40.6 – 54.2 Nm)
- 19.3 Remove access panel:
 - 19.3.1. Remove rear access panel from ChipBLASTER unit (Panel opposite to the Gauge Panel).
 - 19.4 For units without pressure switch:
 - 19.4.1. Remove SAE pipe plug fitting from the high-pressure manifold. This fitting is located on the lower right side of the high-pressure manifold. See Figure 8.

19.0. SYSTEM CONTAMINATION PURGING PROCEDURE (Cont.):

19.4. For units without pressure switch: Refer to Figure 17.

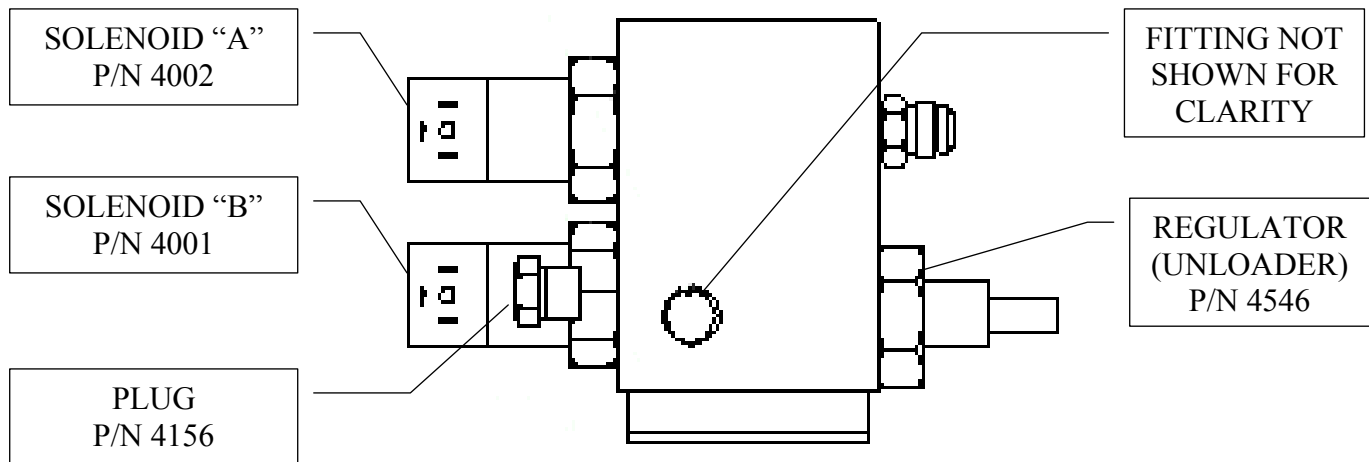


Figure 17

19.4.1. Install Hose Adapter Fitting and attach low-pressure hose.



ATTACH DISCHARGE TO FLUID CONTAINER TO ELIMINATE FLUID SPILLING.

19.5. For units with pressure switch: Refer to Figure 18.

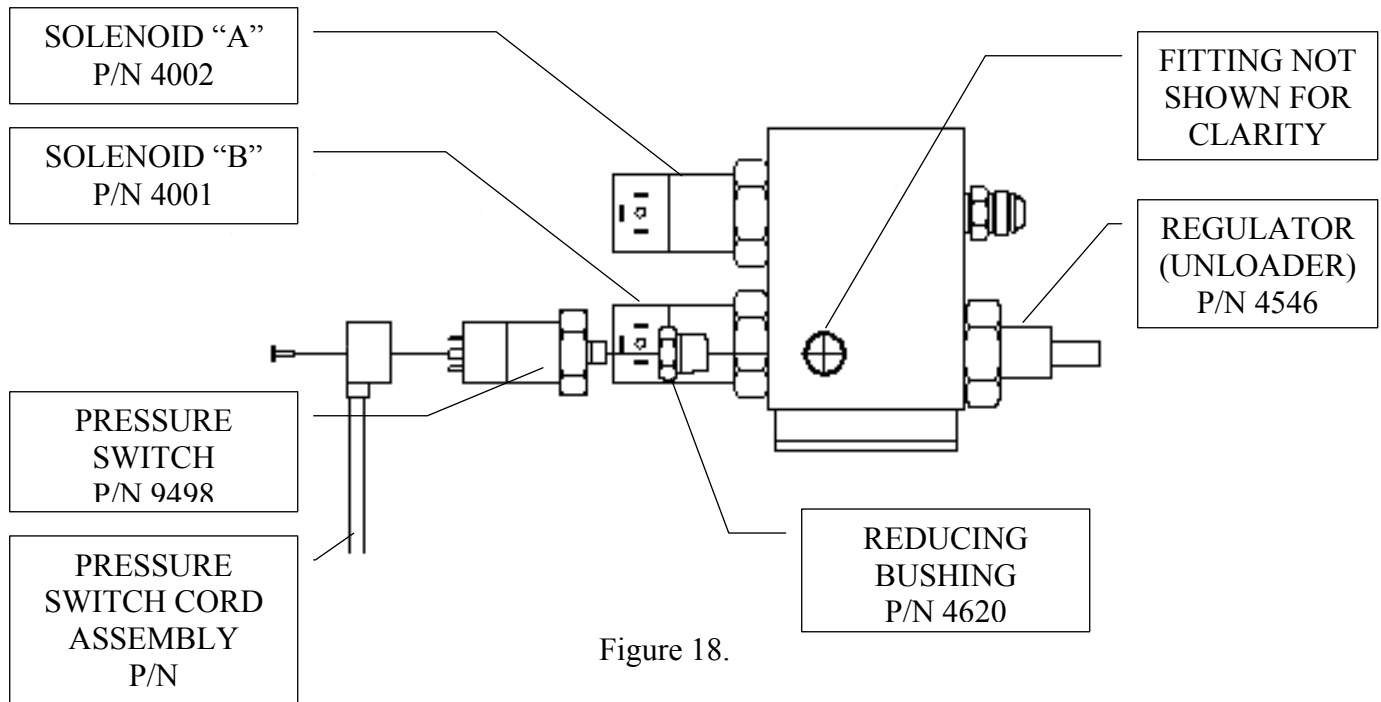


Figure 18.

19.5.1. Remove electrical din connection from pressure switch.

19.5.2. Remove pressure switch.

19.5.3. Remove 1/2" x 1/8" reducing bushing. See Figure 18.

19.0. SYSTEM CONTAMINATION PURGING PROCEDURE (Cont.):

19.5.4. Install hose adapter fitting and attach low-pressure hose.



NOTE: ATTACH DISCHARGE TUBE TO FLUID CONTAINER TO ELIMINATE FLUID SPILLING.

19.6. FLUSHING CYCLE

19.6.1. Press the AIR PURGE / RESET pushbutton located on the front of ChipBLASTER's electrical enclosure.

19.6.2. Continue pressing the AIR PURGE /RESET pushbutton until 5 gallon container is full.

19.6.3. Close the Air Bleeder Valves located on the upper portion of the filter.

19.6.4. Press the AIR PURGE /RESET pushbutton again to continue flushing cycle. Fill the 5-gallon container an addition (3) times to complete the flushing cycle.

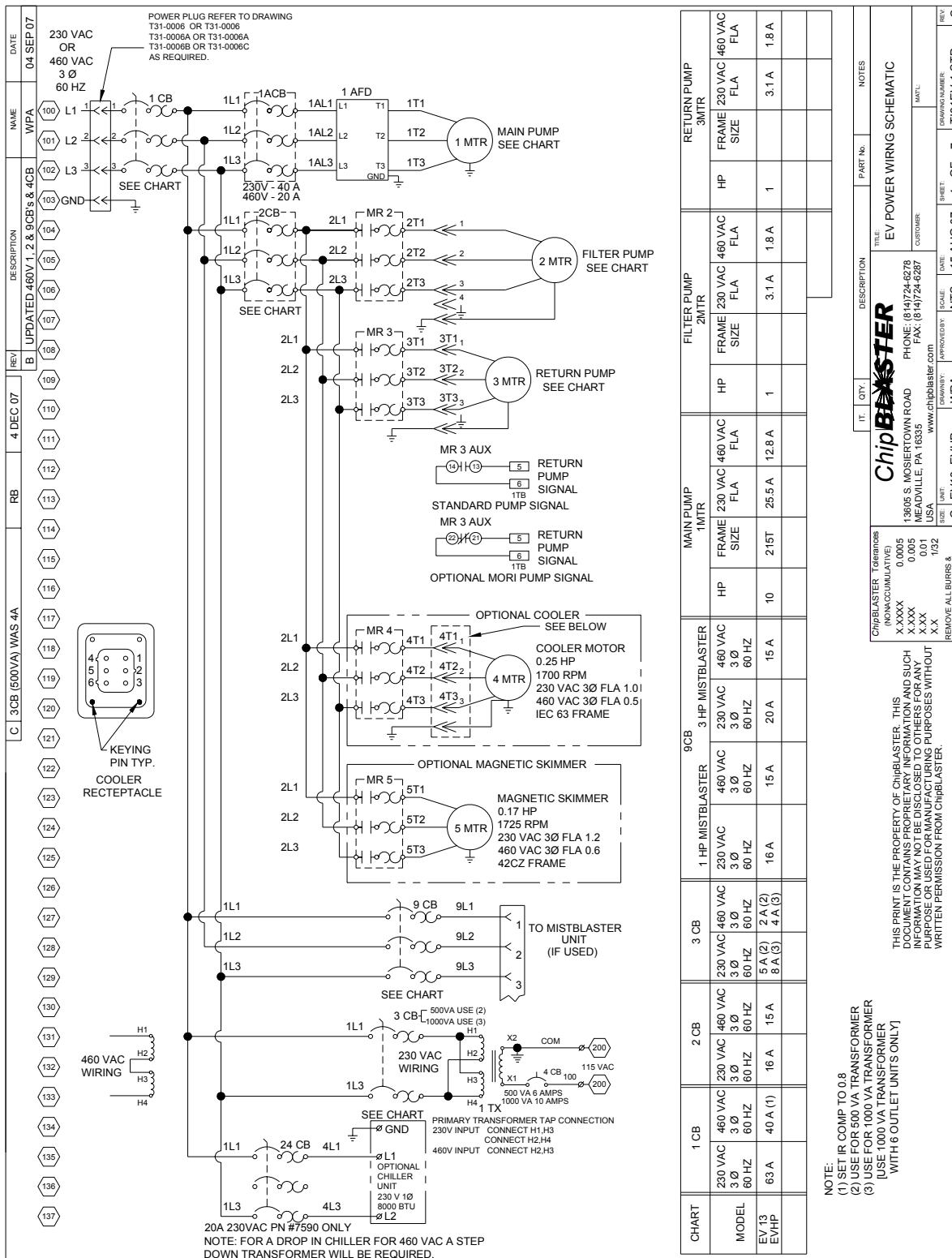
19.7. REPLACE ALL PLUMBING FITTINGS AND PANELS TO THEIR ORIGINAL CONFIGURATION.

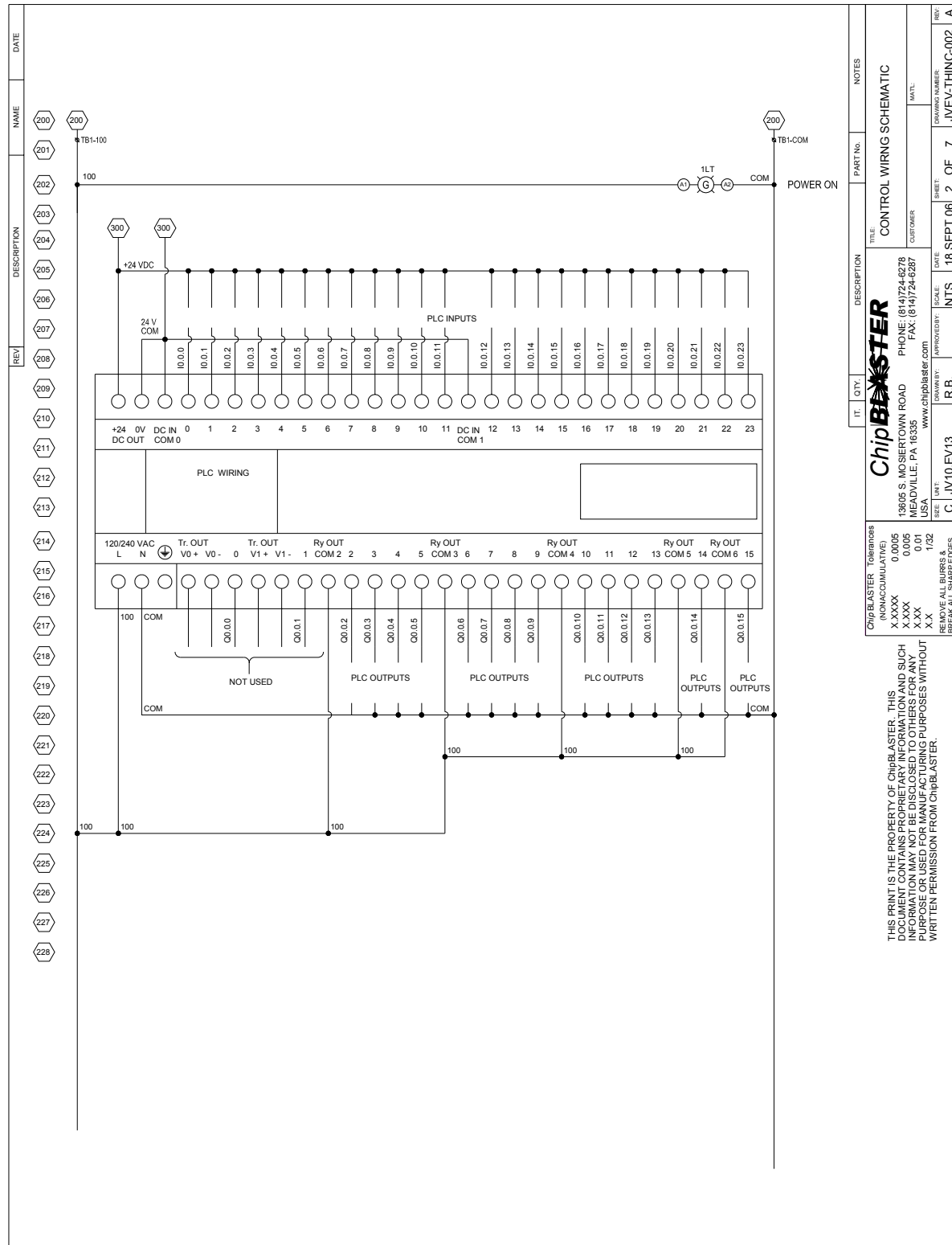


REPLACE ALL GUARDS BEFORE OPERATING ChipBLASTER

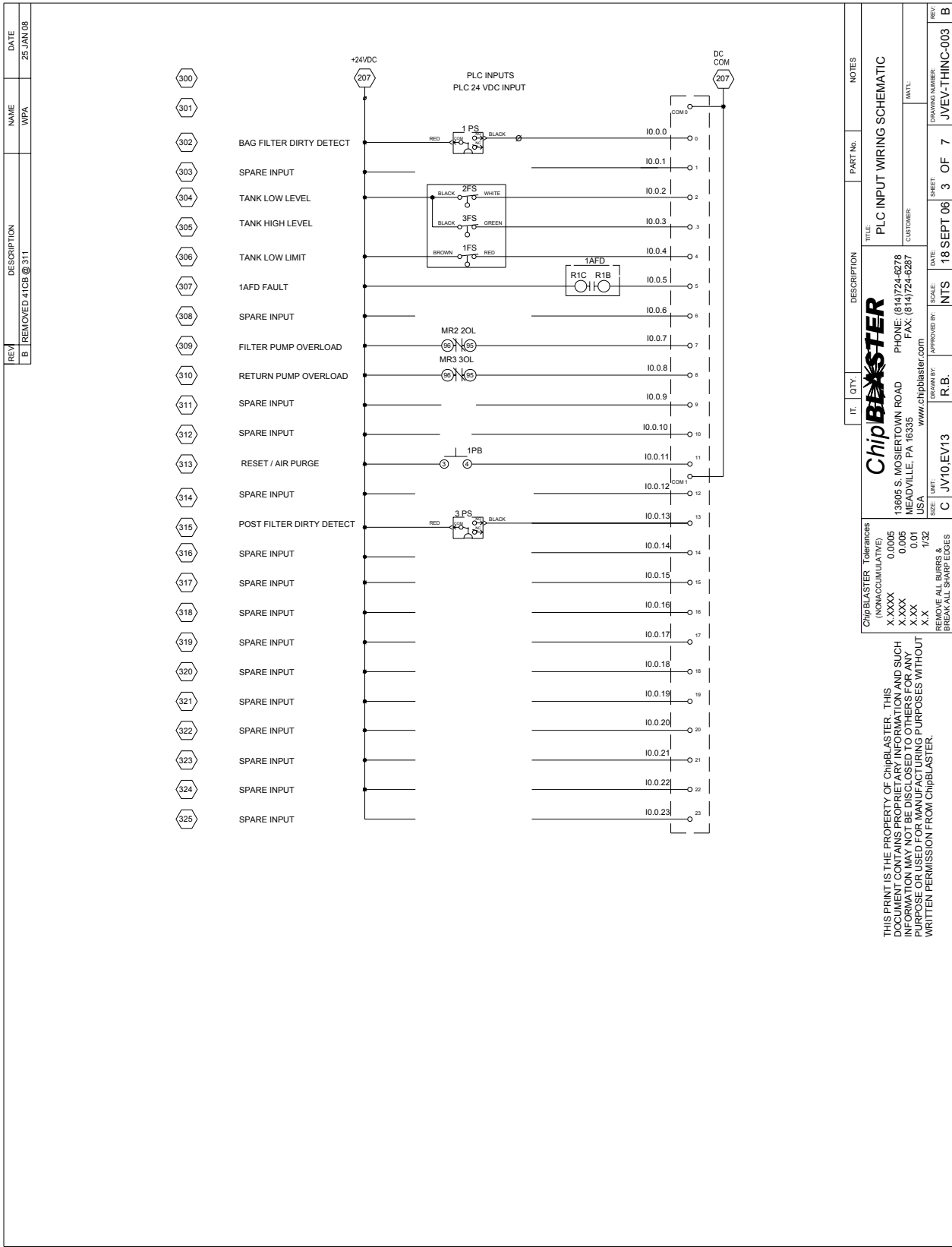
Any questions on the Contamination Purging Procedures, please contact the ChipBLASTER Service Department at (814) 724-6278. Have the model and serial number of your ChipBLASTER unit.

20.1. Power Wiring Schematic:

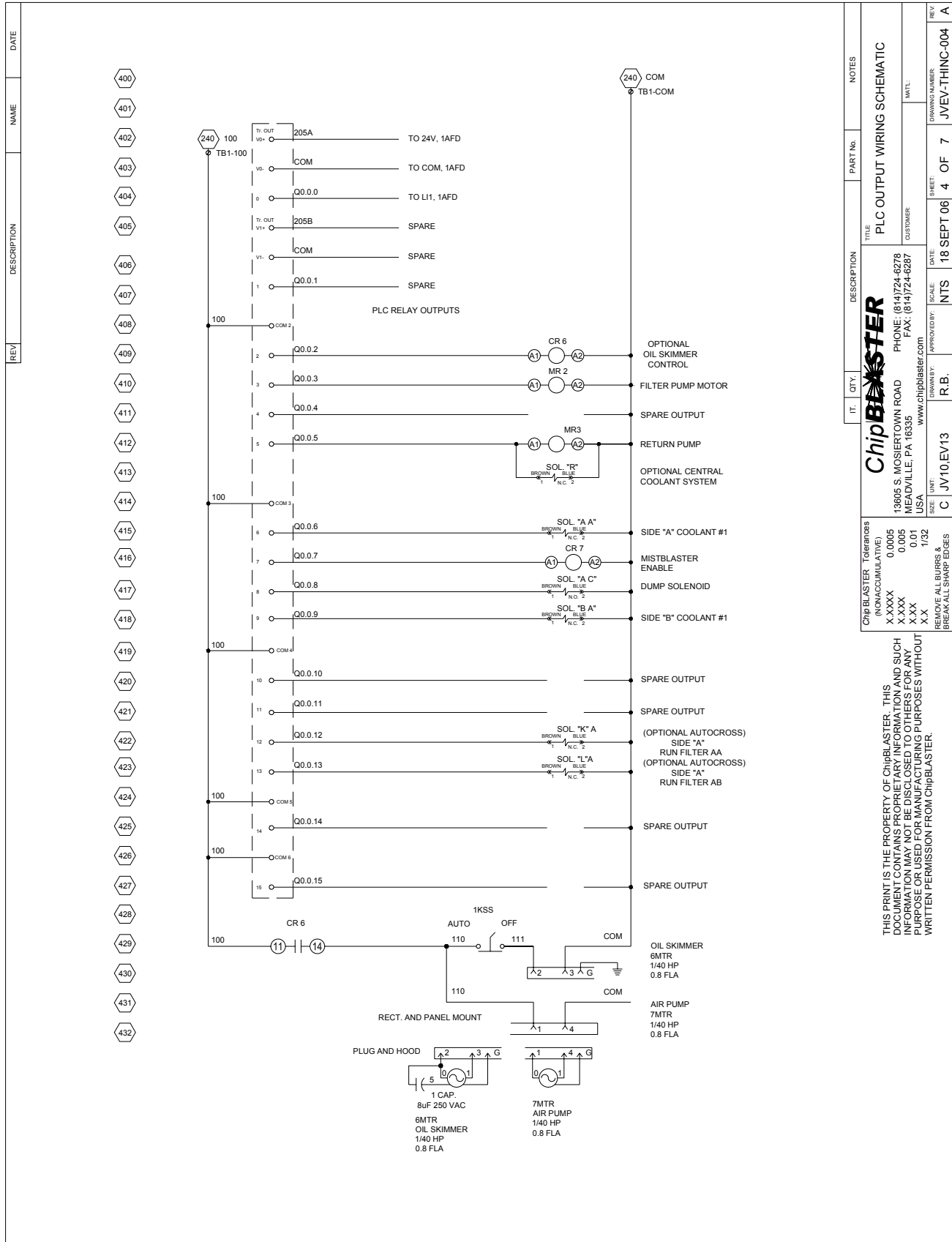




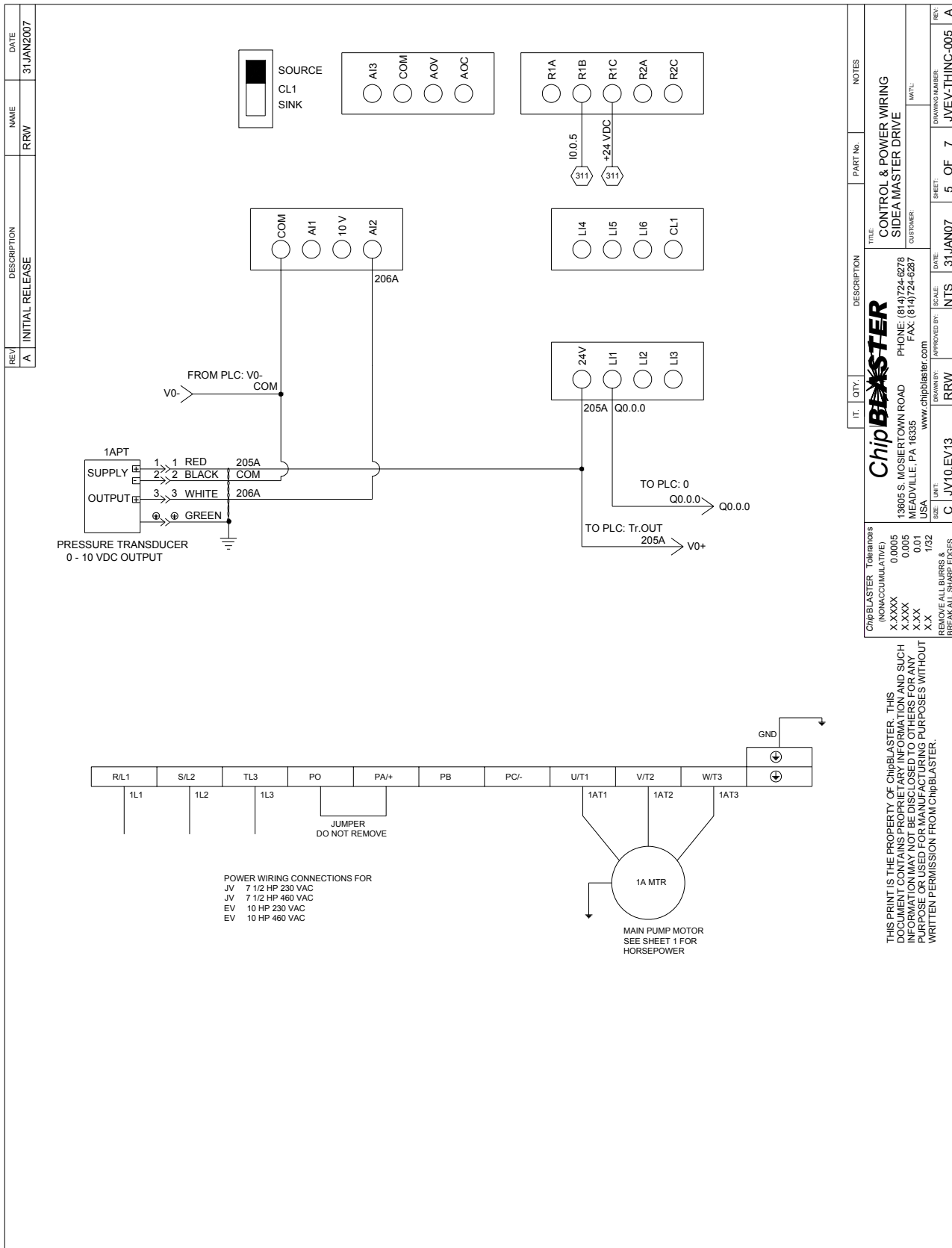
ChipBLASTER, Inc.
20.5. PLC Input Wiring:

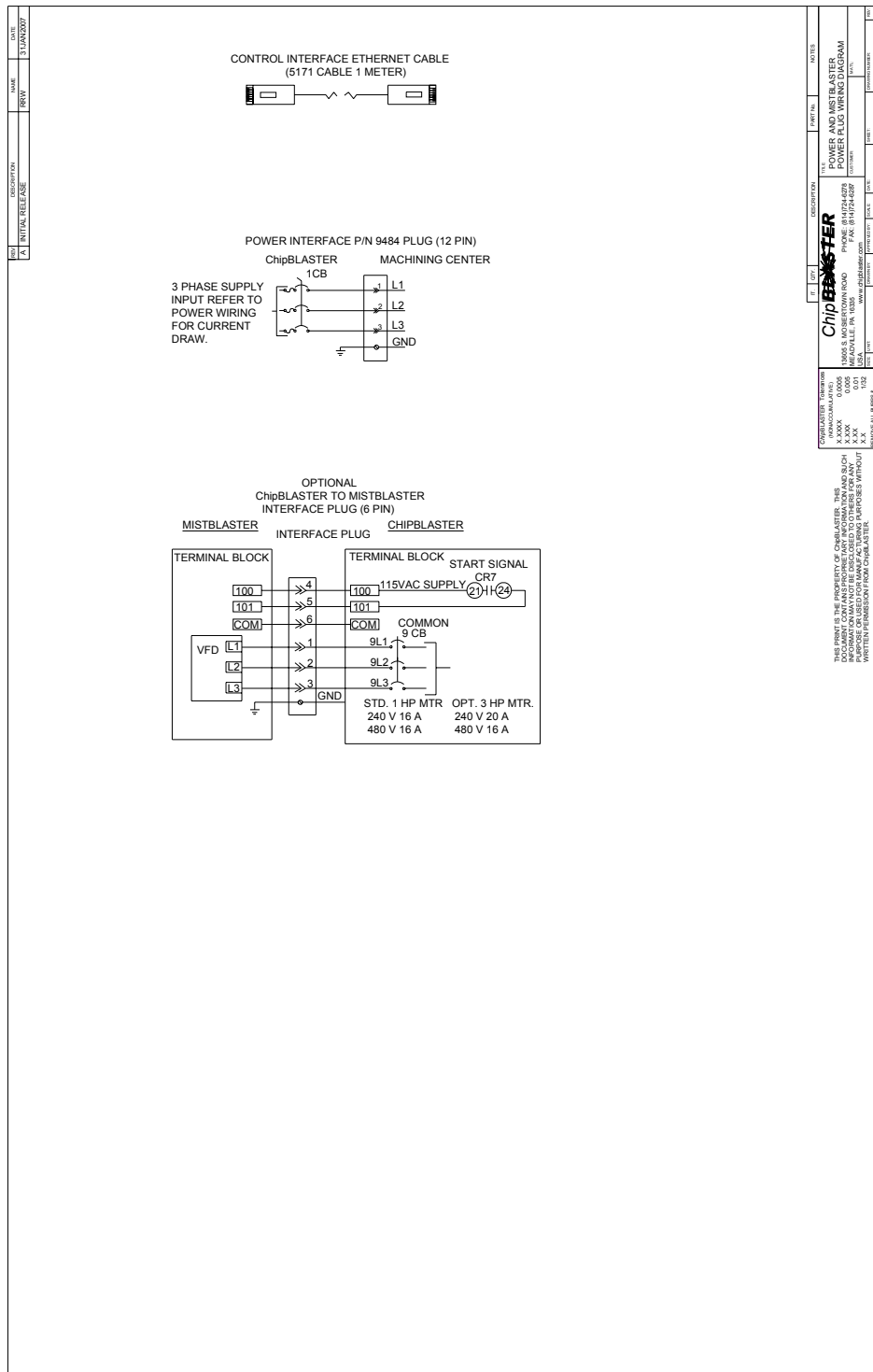


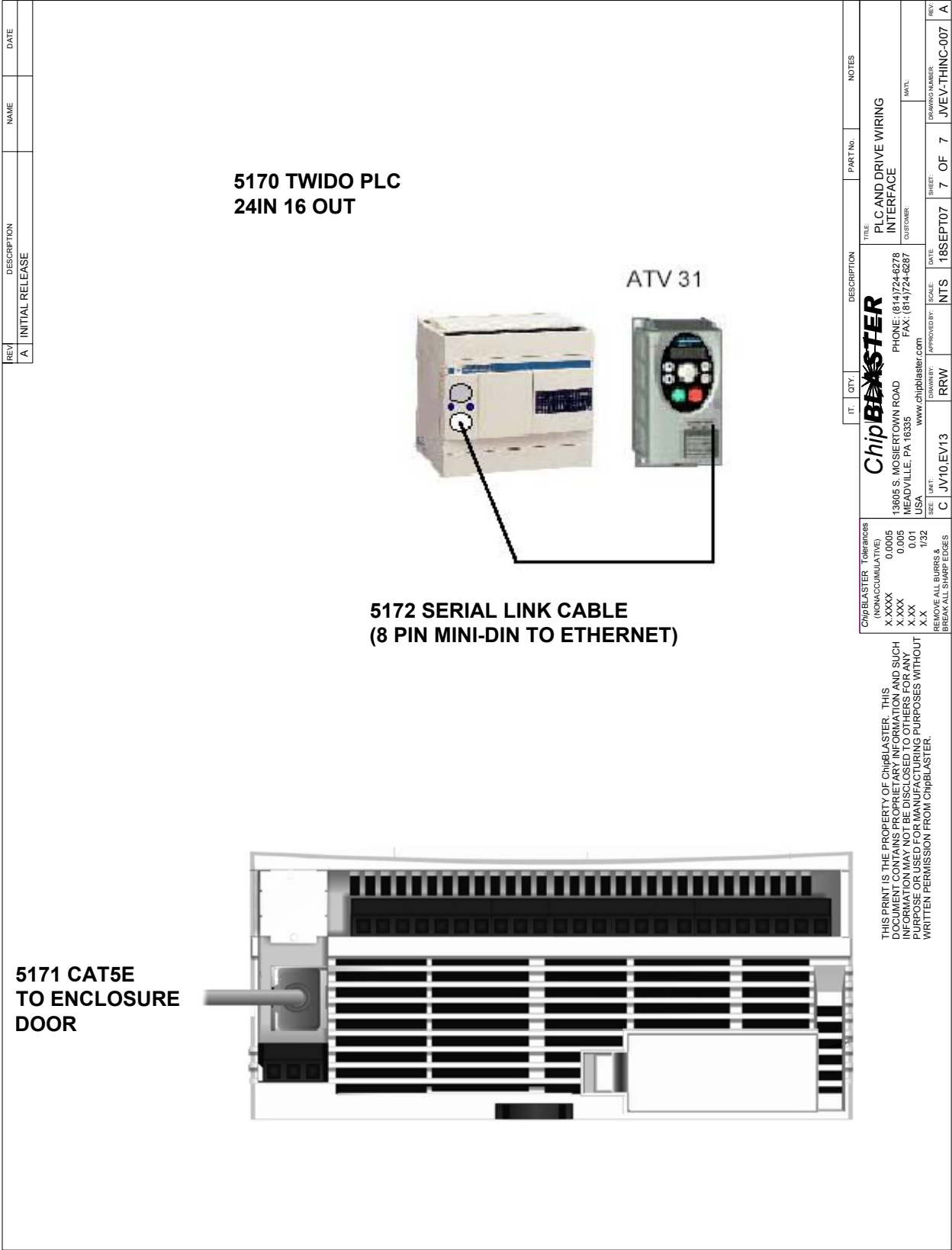
ChipBLASTER, Inc.
20.7. PLC Output Wiring:

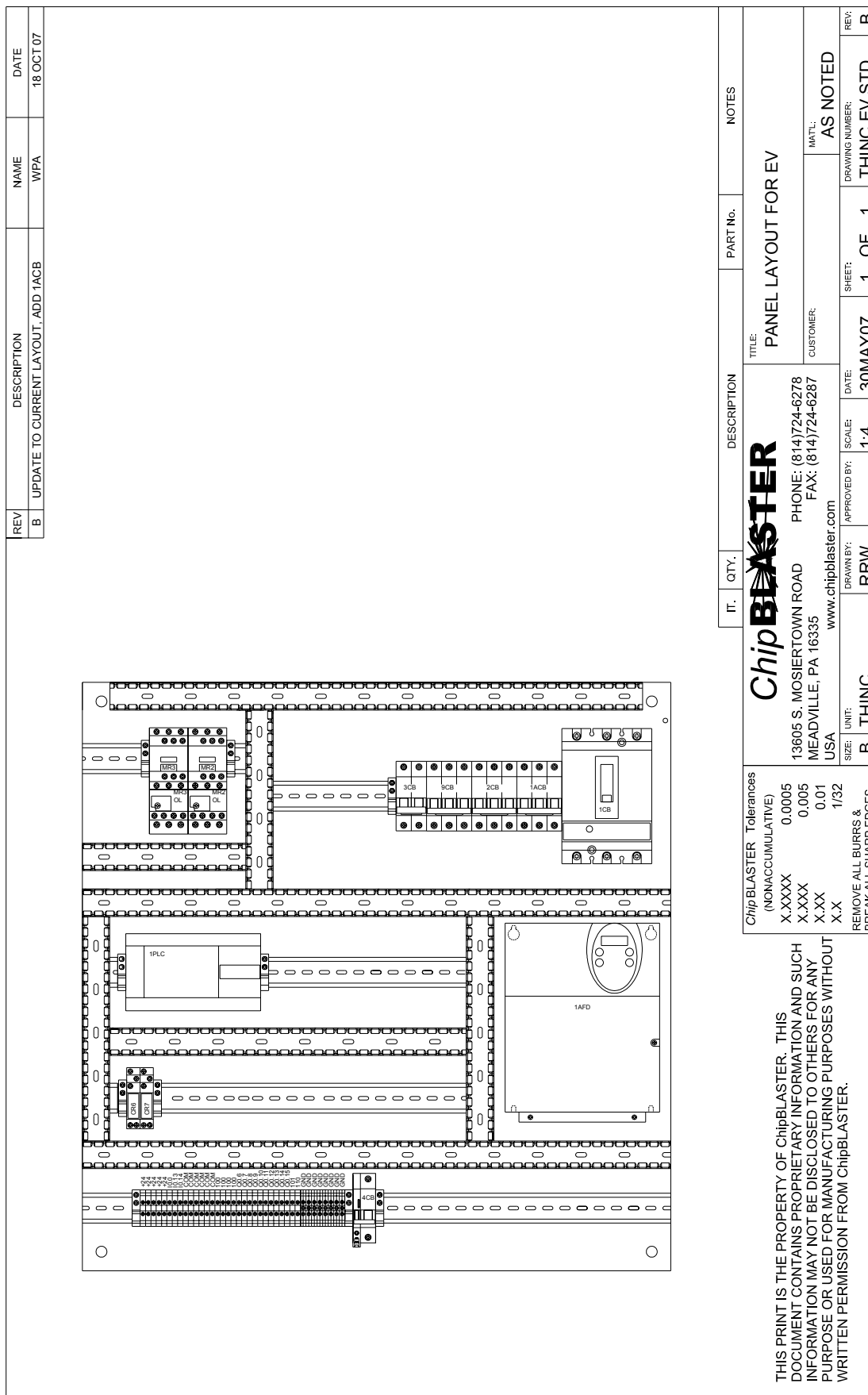


20.9. Drive Control and Power Wiring:





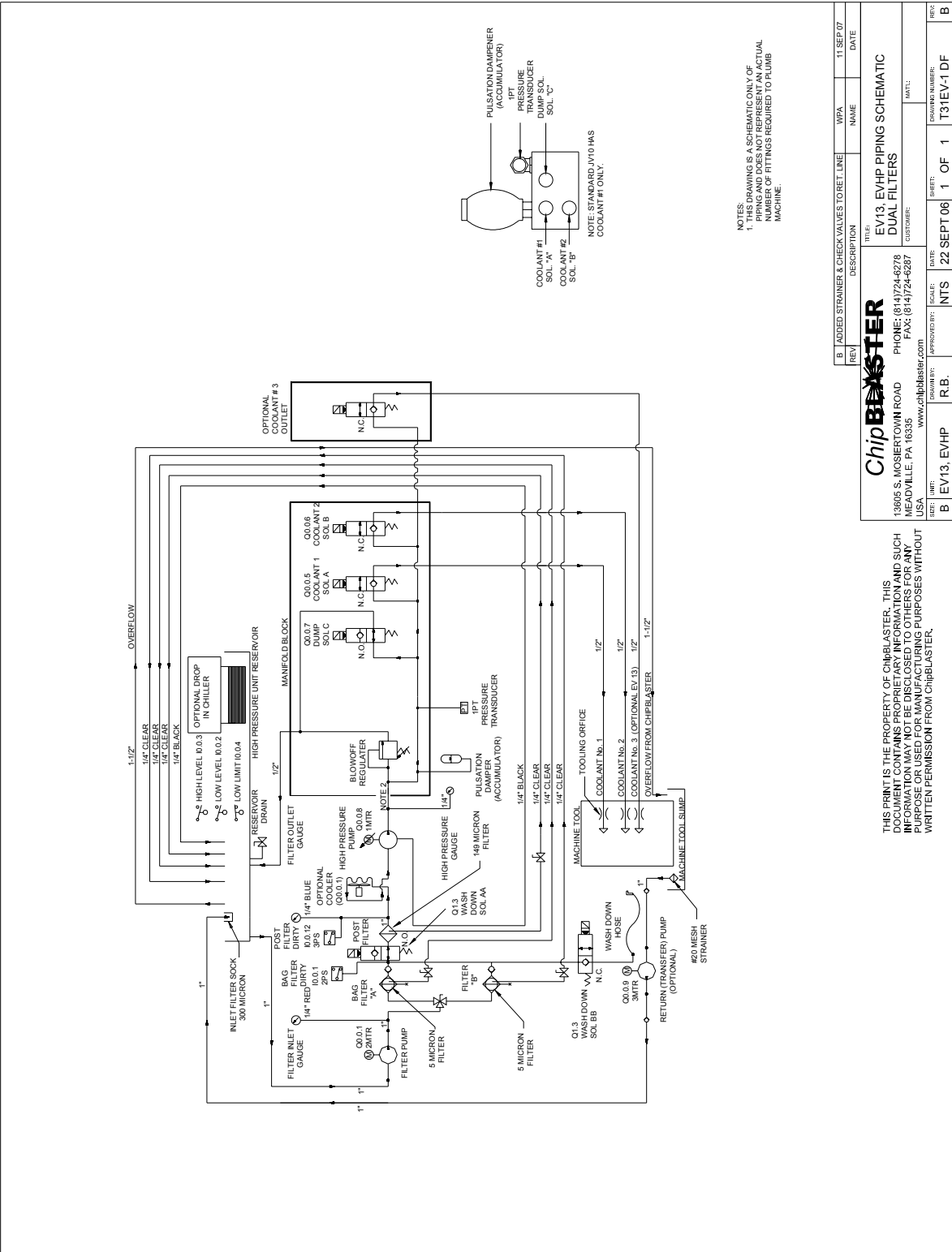






ChipBLASTER, Inc.

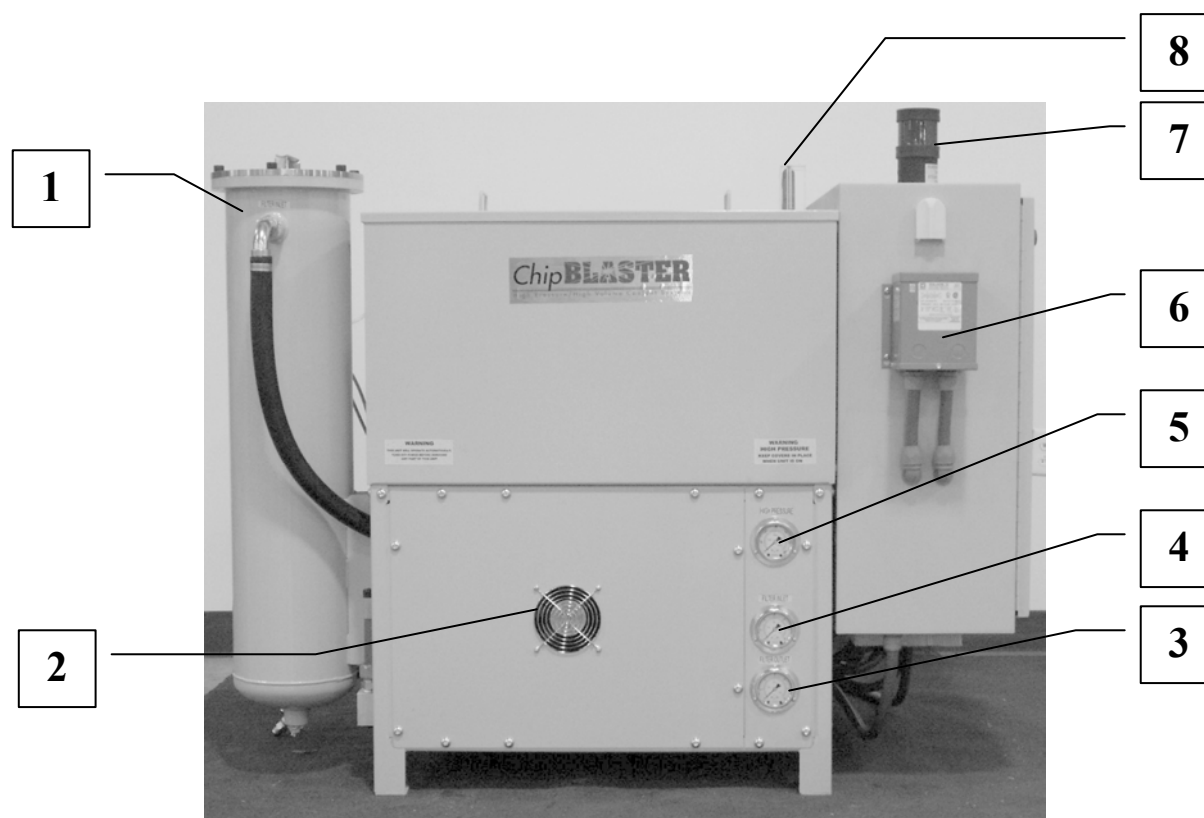
21.2. Dual Filter Schematic Piping:





22.1. EV Gage Panel Side Mechanical Assembly:

ITEM No.	DESCRIPTION	PART No.
1	BAG FILTER CANISTER	3200
2	MACHINE VENT FAN	5986
3	FILTER OUTLET GAUGE	4077
4	FILTER INLET GAUGE	4077
5	HIGH PRESSURE GAUGE	EV13 4025 EVHP 4026
6	CONTROL TRANSFORMER	5781
7	BAG FILTER / POST FILTER DIRTY LIGHT	7538,9
8	TANK FLOAT SWITCH	5968-B
9		
10		
11		
12		
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14		
15		



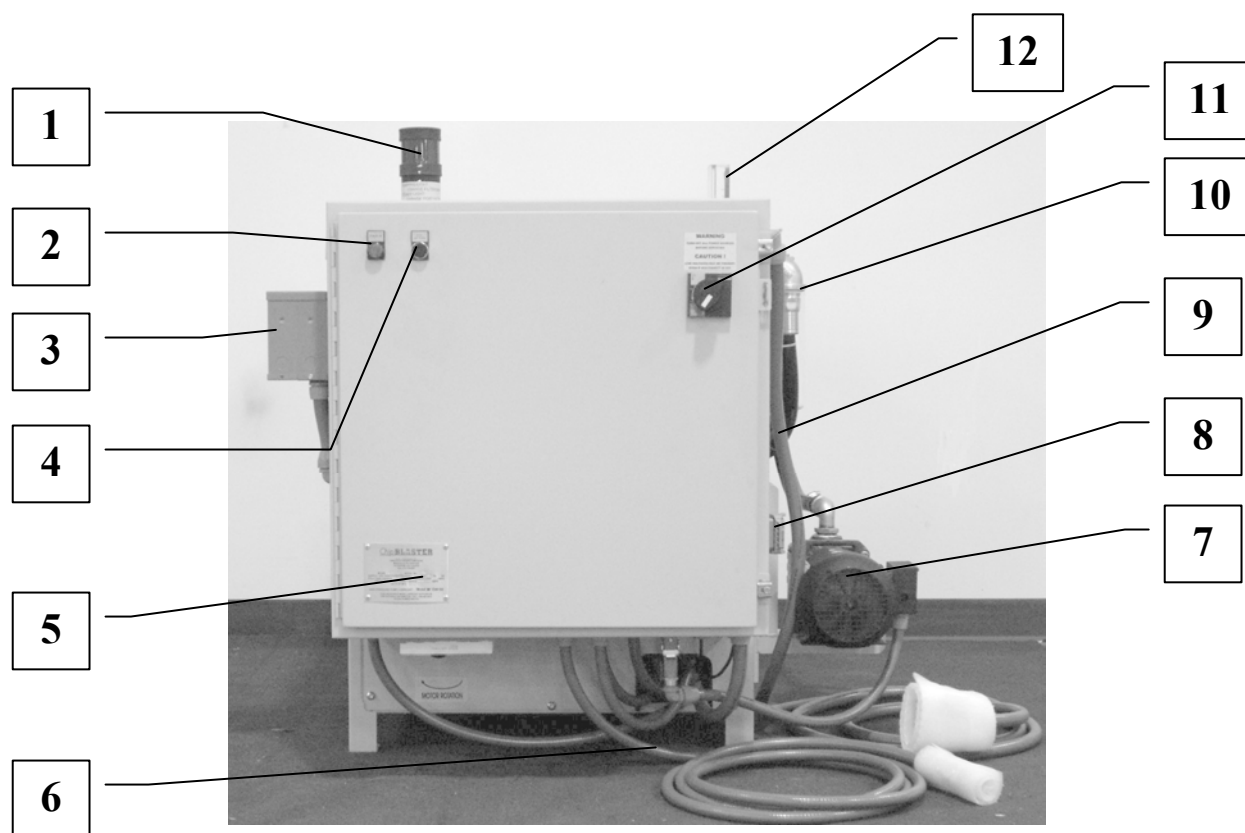
22.6. EV Single Filter Side Mechanical Assembly:

ITEM No.	DESCRIPTION	PART No.
1	POST FILTER	3536
2	RETURN PUMP (OPTIONAL)	3510
3	HIGH PRESSURE COOLANT OUTLET #1	N/A
4	HIGH PRESSURE COOLANT OUTLET #2	N/A
5	OIL SIGHT GAUGE (BEHIND FILTER)	8681
6	BAG FILTER CANISTER	3200
7	FILTER BLEED VALVE	4074
8	POST FILTER BLEED VALVE	4074
9		
10		
11		
12		
13		
14		
15		



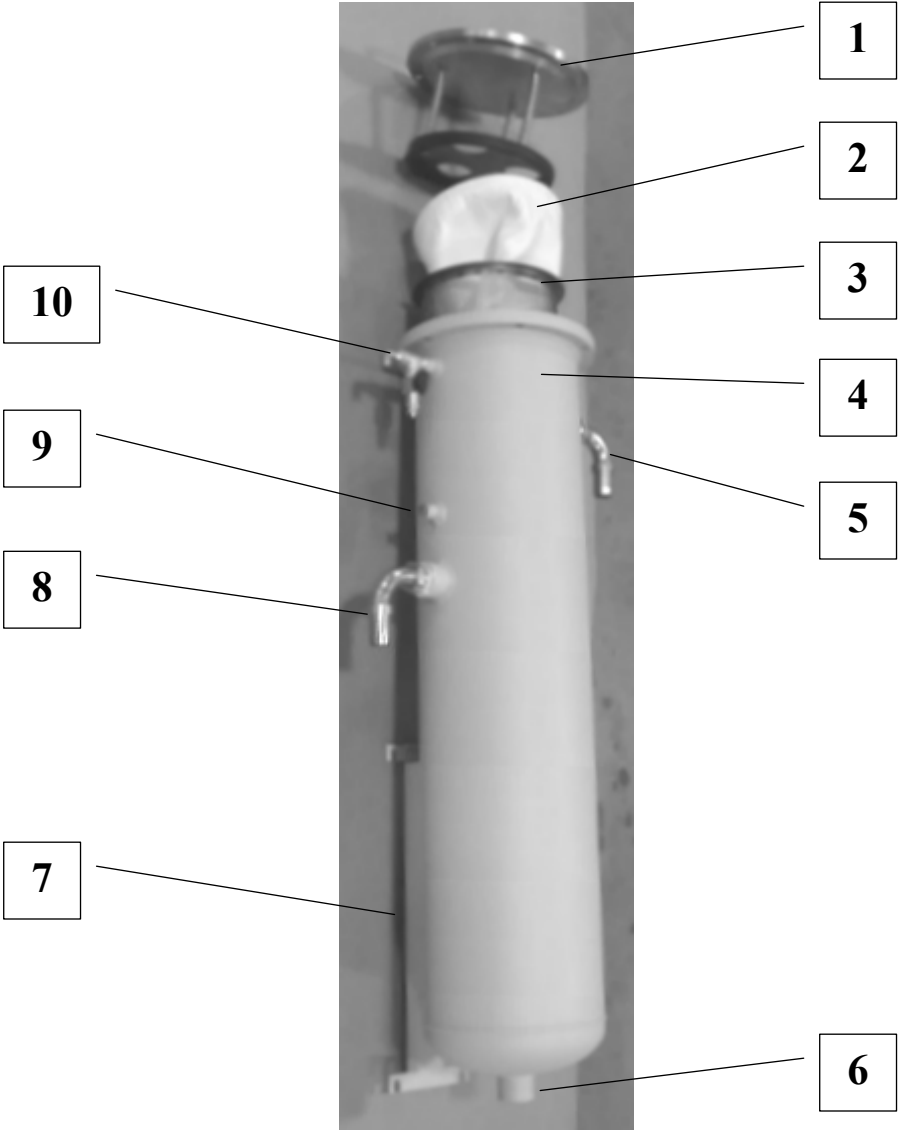
22.11. EV Control Panel Side Mechanical Assembly:

ITEM No.	DESCRIPTION	PART No.
1	BAG FILTER / POST FILTER DIRTY LIGHT	7538,9
2	POWER ON LIGHT	5753
3	CONTROL TRANSFORMER	
4	RESET / AIR PURGE PUSHBUTTON	5107
5	DATA NAMEPLATE	661
6	CONTROL SIGNAL INTERFACE CABLE(S)	9486
7	OPTIONAL RETURN PUMP	3510
8	MISTBLASTER POWER AND CONTROL INTERFACE RECEPTACLE	5731,2
9	POWER INTERFACE CABLE	9484
10	TANK OVER FLOW	NA
11	MAIN DISCONNECT	5847
12	TANK FLOAT SWITCH	5968-B
13		
14		
15		



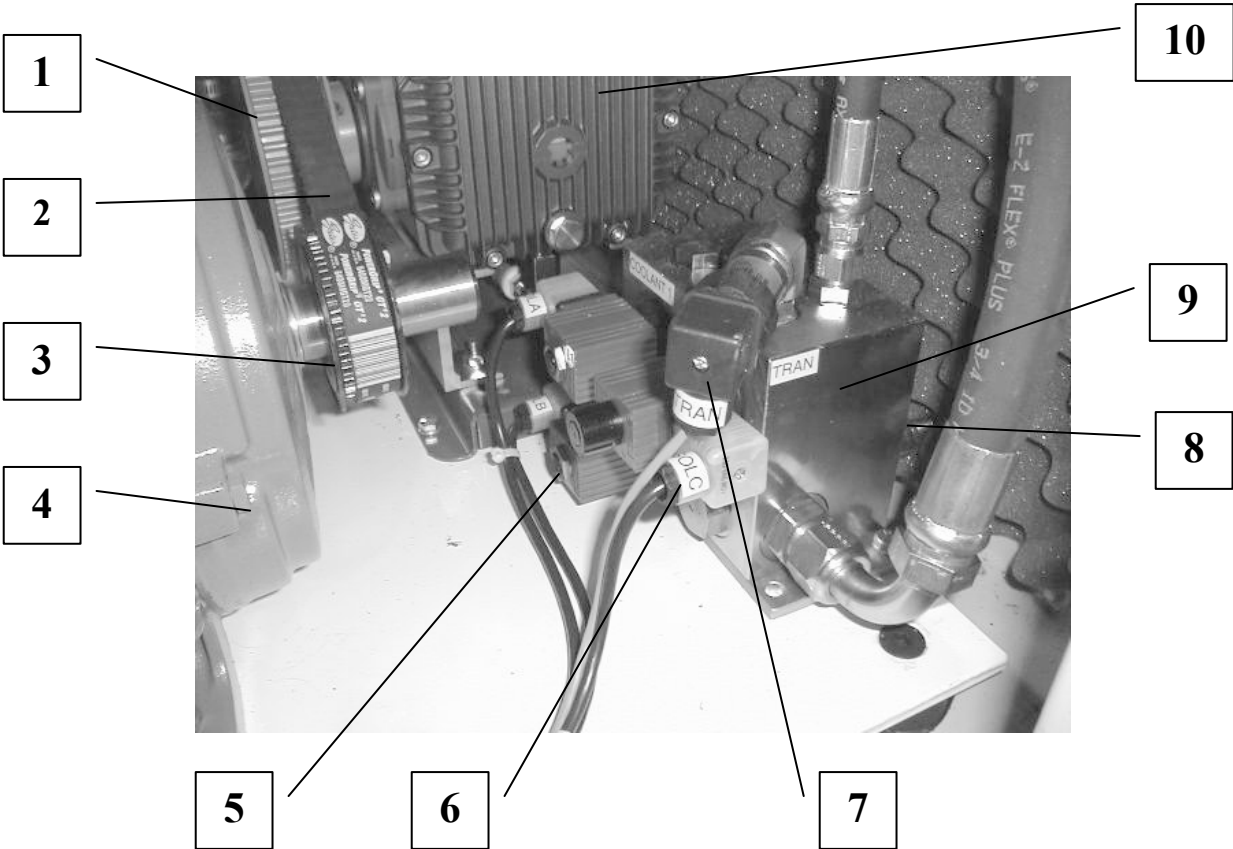
22.16. EV Filter Mechanical Assembly:

ITEM No.	DESCRIPTION	PART No.
1	FILTER LID WITH BAG HOLD DOWN	3201A
	"O" RING SEAL 8" (NOT SHOWN)	2571
2	FILTER BAG 8" x 30" (5 Micron)	3013-5
3	BASKET SCREEN 8"	3024-R2
4	FILTER HOUSING JV and EV	3200
5	FLUID OUTLET	N/A
6	FILTER DRAIN	N/A
7	FILTER MOUNTING BRACKET	8700-17
8	FLUID INLET	N/A
9	GAUGE PORT (USED ON "J" UNITS ONLY)	N/A
10	FILTER BLEED (AIR PURGE) USED ON JV,EV,GV,CV	N/A



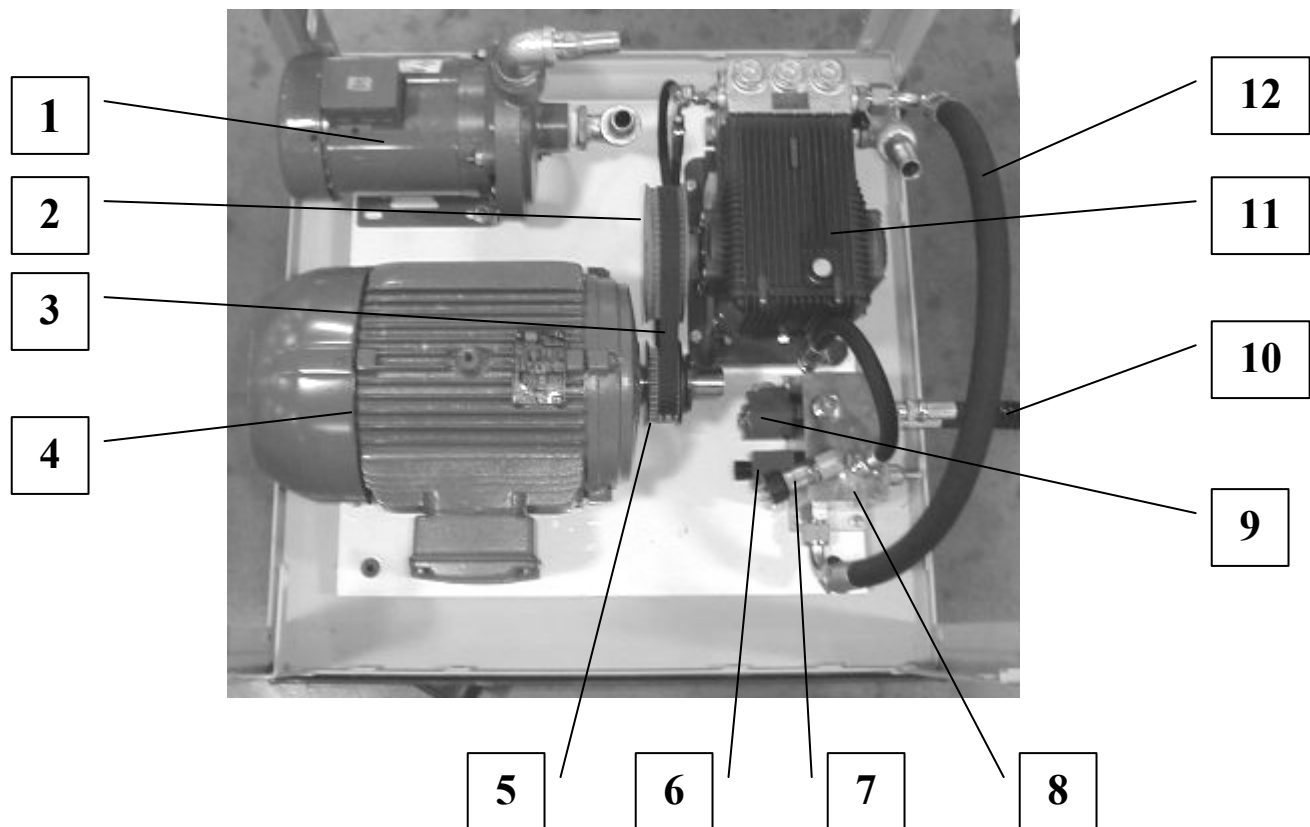
22.17. EV Manifold Block Assembly:

ITEM No.	DESCRIPTION	PART No.
1	PUMP SHEAVE EV13	2544
	PUMP SHEAVE EVHP	2260
2	DRIVE BELT EV13	2412
	DRIVE BELT EVHP	2556
3	DRIVE SHEAVE EV13	2595
	DRIVE SHEAVE EVHP	2944
4	PUMP MOTOR	2013
5	SOLENOID VALVE N.O.	4002
6	SOLENOID VALVE N.C.	4001
7	PRESSURE TRANSDUCER EV13	9662
	PRESSURE TRANSDUCER EVHP	9670
8	UNLOADER (REGULATOR) EV13	4546
	UNLOADER (REGULATOR) EVHP	4642
9	MANIFOLD BLOCK	8967-01
10	HIGH PRESSURE PUMP	2119
11		
12		
13		



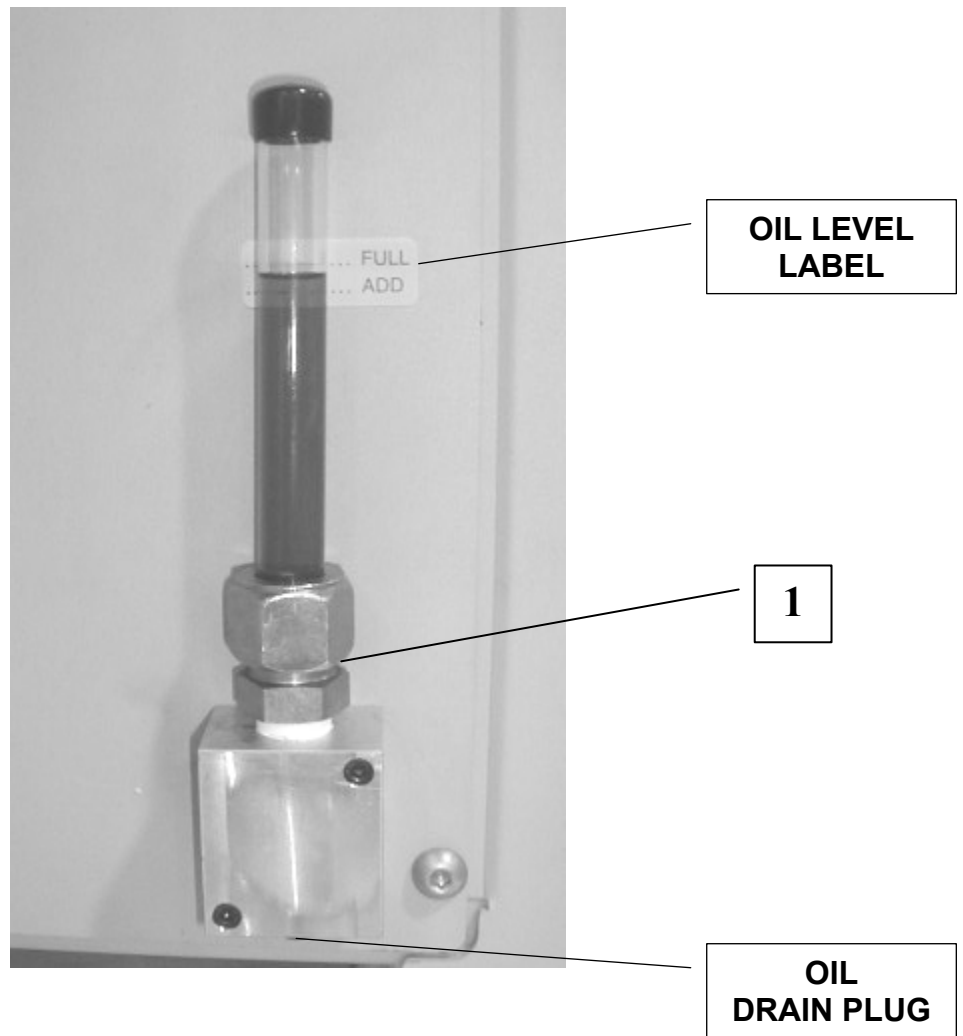
22.22. EV Sub Plate Plain View Mechanical Assembly:

ITEM No.	DESCRIPTION	PART No.
1	FILTER PUMP	4251A
2	PUMP SHEAVE EV13 PUMP SHEAVE EVHP	2544 2260
3	DRIVE BELT EV13 DRIVE BELT EVHP	2412 2556
4	PUMP MOTOR	2013
5	DRIVE SHEAVE EV13 DRIVE SHEAVE EVHP	2595 2944
6	SOLENOID VALVE N.O.	4002
7	PRESSURE TRANSDUCER EV13 PRESSURE TRANSDUCER EVHP	9662 9670
8	MANIFOLD BLOCK	8967-01
9	SOLENOID VALVE N.C.	4001
10	HIGH PRESSURE COOLANT OUTLET	N/A
11	HIGH PRESSURE PUMP	2119
12	HIGH PRESSURE SUPPLY HOSE	N/A



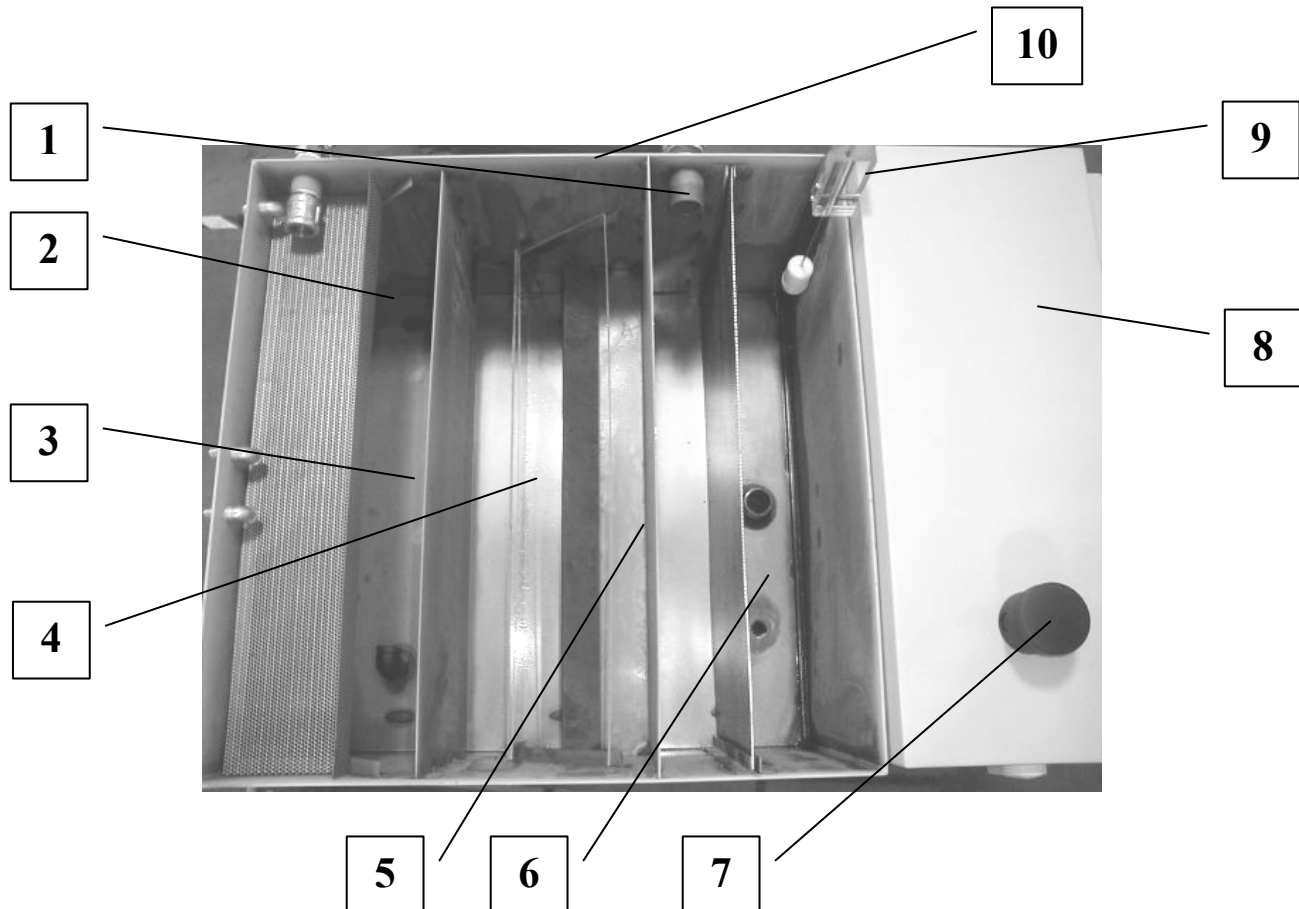
22.27. EV Oil Level Sight Mechanical Assembly:

ITEM No.	DESCRIPTION	PART No.
1	OIL SIGHT GAUGE ASSEMBLY	8681
2		
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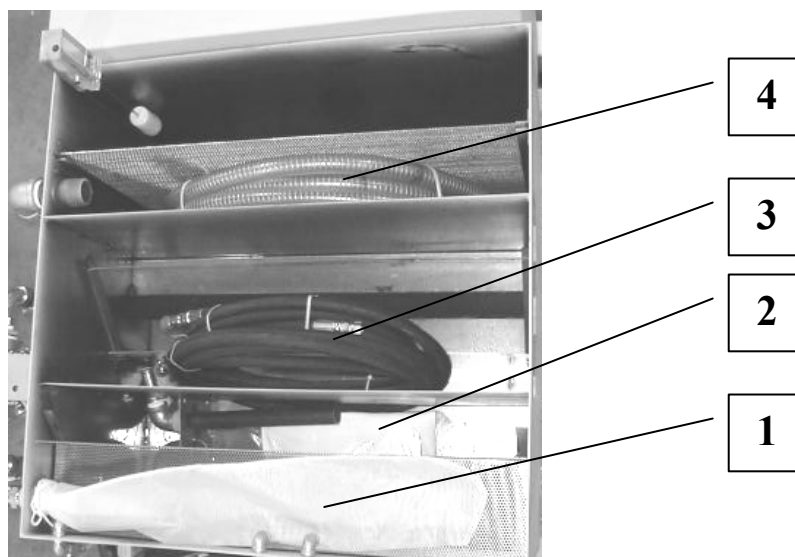
22.28. EV Tank Plan View With Screens and Baffles Mechanical Assembly:

ITEM No.	DESCRIPTION	PART No.
1	OVERFLOW	NA
2	DIRTY COOLANT COMPARTMENT	NA
3	BAFFLE	NA
4	TRAMP OIL COLLECTION BAFFLE	9500
5	REMOVABLE BAFFLE	NA
6	CLEAN COOLANT COMPARTMENT	NA
7	CONTROL ENCLOSURE	5630
8	DIRTY FILTER LIGHT	7538 7539
9	FLOAT SWITCH ASSEMBLY	5968-B
10	SEMI CLEAN COOLANT COMPARTMENT	N/A
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16		



22.33. EV Ship Loose Items:

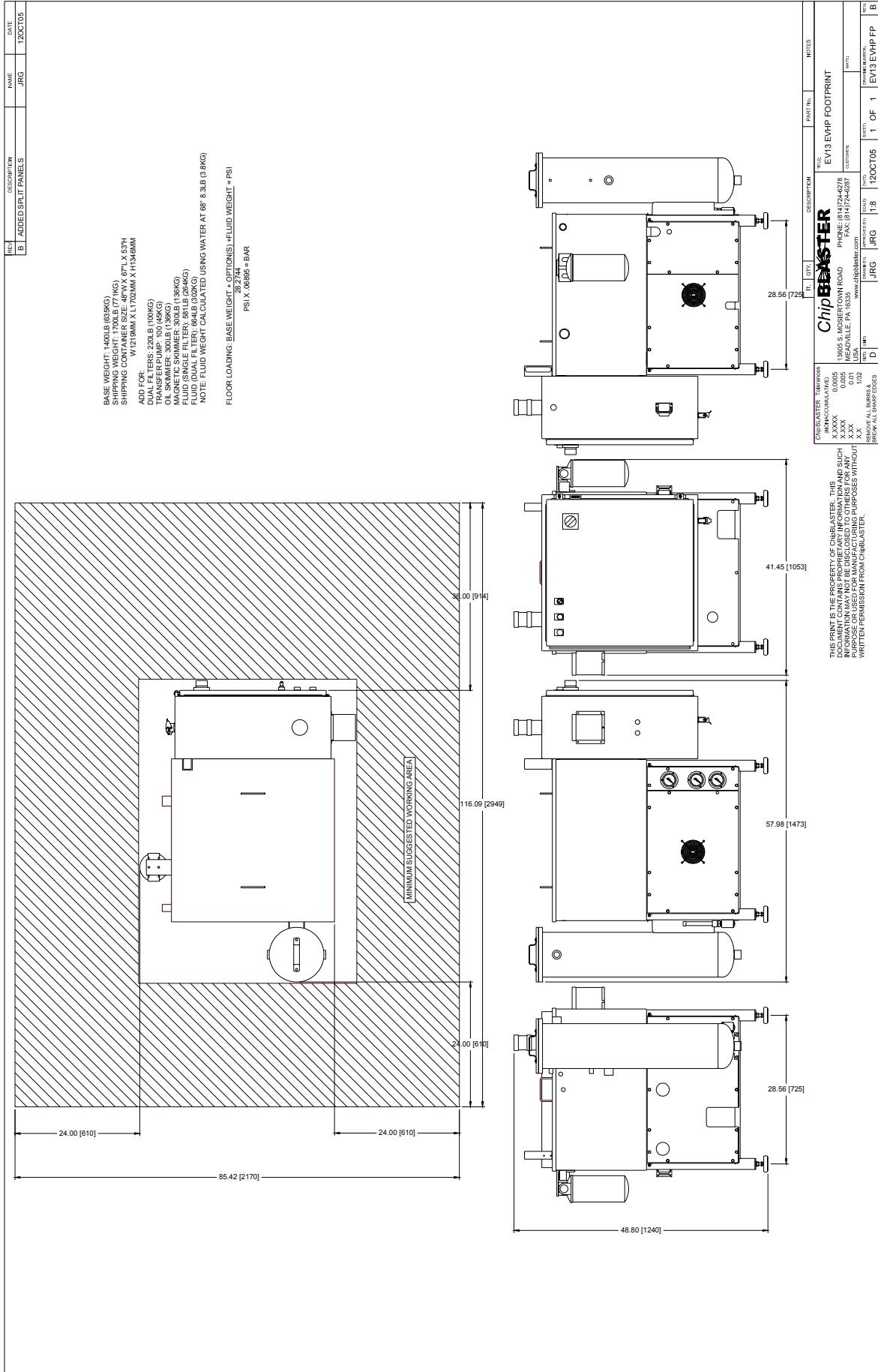
ITEM No.	DESCRIPTION	PART No.
1	PREFILTER SOCK	3017-300
2	SPARE BAG FILTER LEVELING FEET	3013-5 8269A
3	HIGH PRESSURE HOSE	4736
4	LOW PRESSURE RETURN HOSE	9543
5		
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22.38 EV13, EVHP Spare Parts (Recommended) Listing:

SPARE PARTS				
ITEM No.	DESCRIPTION	PART No.	EV KIT PART NO.	EVHP KIT PART NO.
			30017	30017HP
			QT'Y. / KIT	QT'Y. / KIT
1	SOLENOID VALVE N.O.	4002	1	1
2	SOLENOID VALVE N.C.	4001	1	1
3	UNLOADER(REGULATOR) 3000 PSIG	4546	1	1
4	UNLOADER(REGULATOR) 5000 PSIG	4642	0	1
5	TRANSDUCER 0 - 2000 PSIG	9662	1	0
6	TRANSDUCER 0 - 5000 PSIG	9670	0	1
7	HIGH PRESSURE PUMP NOT INCLUDED IN SPARE PARTS KIT FOR REFERENCE ONLY	2119	1	1
8	MAIN DRIVE BELT	2412	1	0
9	MAIN DRIVE BELT	2611	0	0
10	MAIN DRIVE BELT	2621	0	0
11	MAIN DRIVE BELT	2556	0	1
12	MAIN DRIVE BELT	2938	0	0
13	PRESSURE SWITCH	9668	1	1

23.1. EV Footprint Drawing:



24.0. WARRANTY:**24.1. WARRANTY (LIMITED) – NEW EQUIPMENT****ChipBLASTER, Inc. Limited Warranty - New Equipment**

Limited Warranty. ChipBLASTER, Inc. warrants its ChipBLASTER™ high-pressure coolant systems to be free from defects in materials and workmanship for the lesser of one year or 4160 hours of operation from the date of original installation, subject to the conditions set forth below. During this warranty period, ChipBLASTER will repair or replace, at its sole option, defective products or parts without charge to the purchaser.

Limited Warranty Conditions:

- 24.1.1 Limited warranty applies only to new ChipBLASTER equipment, and is solely for the benefit of and applicable to the end user.
- 24.1.2 This limited warranty does not apply to any damage, failure, defect or loss caused by any or all of the following circumstances or conditions: failure to follow instructions or observe cautions and warnings relating to installation, operation, applications, inspection and “regular maintenance”¹, as specified in this warranty and/or any ChipBLASTER manual, quotation, acknowledgment, spec. sheet or installation instructions (all of which shall hereinafter be referred to as “applicable literature”); use of ChipBLASTER equipment outside the parameters of “normal usage” including, but not limited to, misapplication, misuse, failure to follow directions and instructions provided by ChipBLASTER applicable literature; any damage or loss to products or parts which results from the alteration, repair, modification, faulty installation, or service (other than regular maintenance) by any one other than an authorized ChipBLASTER service technician; the use of any add-ons, parts, accessories or components not obtained from ChipBLASTER or an authorized ChipBLASTER supplier or approved in writing by ChipBLASTER; damage to products or parts caused by accident, abuse or misuse; replacement of filters¹; normal wear and tear; damage which occurs in shipment or as a result of an act of God, such as lightening, or electrical failures such as line surges or brownouts.
- 24.1.3. Any replacement equipment or parts provided to the purchaser in fulfilling this warranty are warranted for the un-expired portion of the original warranty.
- 24.1.4. If any ChipBLASTER products are found upon ChipBLASTER’s examination in response to a warranty claim to have defects in material or workmanship, ChipBLASTER will either replace or repair the product, at its sole option.
- 24.1.5. ChipBLASTER expects that warranty repairs will be completed at the purchaser’s location; however, if requested by ChipBLASTER, purchaser shall return the alleged defective product to ChipBLASTER for examination, at ChipBLASTER’s direction. ChipBLASTER will reimburse the purchaser for the expense incurred in returning any product to ChipBLASTER if ChipBLASTER has provided prior written authorization to the purchaser and the problem is covered by this warranty. In the event the problem is not covered by this limited warranty, ChipBLASTER will not be responsible for payment of shipping expense.
- 24.1.6. Other than the obligations imposed upon ChipBLASTER under this limited warranty, ChipBLASTER shall not be liable for any other costs, expenses or losses that the purchaser incurs to remedy any defect.

¹ Regular maintenance includes the minor normal maintenance required to be performed by buyer, at buyer’s expense as set forth in the maintenance schedule included with this warranty as Exhibit A and posted on the outside panel of the ChipBLASTER. **Use of filters other than ChipBLASTER will void warranty coverage for any filtration related damage or failures.**

24.0. WARRANTY (Cont.):

- 24.1.7. Repairs of defects in material or workmanship during the limited warranty period shall be performed only by ChipBLASTER approved service technicians; the cost of repairs performed by others will not be reimbursed by ChipBLASTER unless prior approval is received in writing from ChipBLASTER.
- 24.1.8. This limited warranty shall cover alleged defects in materials and workmanship about which ChipBLASTER receives notice within thirty (30) days of either the discovery of the alleged defect or the expiration of the limited warranty period, whichever is earlier. Any claim not made within this time shall be conclusively deemed to having been waived by the purchaser.
- 24.1.9. Failure of the purchaser to maintain the equipment by completing all of the scheduled maintenance tasks set forth in Exhibit A to this limited warranty entitled "ChipBLASTER Maintenance Schedule" will void this limited warranty, and release ChipBLASTER from any liability hereunder. **ChipBLASTER may require purchaser to provide evidence of timely completion of the scheduled maintenance tasks set forth in Exhibit A.**
- 24.1.10. ChipBLASTER warranty card must be completed by purchaser and returned to ChipBLASTER within 30 days after installation of ChipBLASTER equipment to validate this limited warranty.

Procedures for Obtaining Technical Service or Warranty Service. Repair or replacement under this limited warranty can only be obtained by registering a warranty claim directly with ChipBLASTER. To enable ChipBLASTER to respond to a request for technical assistance or a request for warranty service, the purchaser must provide, at a minimum, the following information during the initial telephone call: model number, serial number and information regarding any optional ChipBLASTER™ components; the date of purchase; the dealer or supplier from whom the equipment was purchased and the nature of the problem or difficulty. A warranty claim form can be obtained by contacting ChipBLASTER at 800-241-3163.

Limitation of Liability. ChipBLASTER's liability under this warranty is limited as set forth herein. This limited warranty and the remedies set forth herein constitute the sole and exclusive remedy available to the purchaser of ChipBLASTER™ equipment covered by this limited warranty, and are in lieu of any or all other remedies, whether based on statements or promises which are oral, written, express or implied, and whether in contract, tort, equity or otherwise.

ChipBLASTER neither extends nor provides any warranty, expressed or implied, on any products not manufactured by or sold by ChipBLASTER. Problems caused to ChipBLASTER™ equipment or other equipment by products used in conjunction with ChipBLASTER™ equipment which are not either manufactured by ChipBLASTER or manufactured to design specifications provided by ChipBLASTER and specifically approved by ChipBLASTER in writing are not the responsibility of ChipBLASTER, either under this warranty, or otherwise.

This warranty excludes all implied warranties of merchantability or fitness for particular purpose or any purpose.

This warranty specifically excludes reimbursement or liability for "downtime," loss of income and/or consequential damages.

In no event will ChipBLASTER's liability to the purchaser resulting from any claim or loss arising out of a purchaser's purchase of ChipBLASTER™ equipment or the operation thereof exceed the purchase price of the product manufactured or sold by ChipBLASTER.

24.0. WARRANTY (Cont.):**24.2 WARRANTY (LIMITED) – USED EQUIPMENT****ChipBLASTER, Inc. Limited Warranty - Used Equipment**

Limited Warranty. ChipBLASTER, Inc. warrants the used ChipBLASTER™ high-pressure coolant systems to be free from defects in materials and workmanship for the lesser of 90 days or 1040 hours from the date of installation, subject to the conditions set forth below. During this warranty period, ChipBLASTER will repair or replace, at its sole option, defective products or parts without charge to the purchaser.

Limited Warranty Conditions:

- 24.2.1 Limited warranty applies only to used ChipBLASTER equipment, and is solely for the benefit of and applicable to initial purchaser.
- 24.2.2 This limited warranty does not apply to any damage, failure, defect or loss caused by any or all the following circumstances or conditions: failure to follow instructions or observe cautions and warnings relating to installation, operation, applications, inspection and regular maintenance², as specified in this manual and/or any ChipBLASTER manual, quotation, acknowledgment, sales literature, spec sheet or installation instructions (all of which shall hereinafter be referred to as “applicable literature”); use of ChipBLASTER equipment outside the parameters of “normal usage” including, but not limited to misapplication, misuse, failure to follow directions and instructions provided by ChipBLASTER applicable literature; any damage or loss to products or parts which results from the alteration, repair, modification, faulty installation, or service (other than regular maintenance) by any one other than an authorized ChipBLASTER service technician and the use of any add-ons, parts, accessories or components not obtained from ChipBLASTER or an authorized ChipBLASTER supplier or approved in writing by ChipBLASTER; damage to products or parts caused by accident, abuse or misuse; replacement of filters¹; normal wear and tear; damage which occurs in shipment or as a result of an act of God, such as lightning, or electrical failures such as line surges or brownouts.
- 24.2.3. Any replacement equipment or parts provided to the purchaser in fulfilling this warranty are warranted for the un-expired portion of the original warranty.
- 24.2.4. If any ChipBLASTER products are found upon ChipBLASTER’s examination in response to a warranty claim to have defects in material or workmanship, ChipBLASTER will either replace or repair the product, at its sole option.
- 24.2.5. ChipBLASTER expects that warranty repairs will be completed at the purchaser’s location; however, if requested by ChipBLASTER, purchaser shall return the alleged defective product to ChipBLASTER for examination, at ChipBLASTER’s direction. ChipBLASTER will reimburse the purchaser for the expense incurred in returning any product to ChipBLASTER if ChipBLASTER has provided prior written authorization to the purchaser and the problem is covered by this warranty. In the event the problem is not covered by this limited warranty, ChipBLASTER will not be responsible for payment of shipping expense.

²Regular maintenance includes the minor normal maintenance required to be performed by buyer, at buyer’s expense as set forth in the maintenance schedule included with this warranty as Exhibit A and posted on the outside panel of the ChipBLASTER. **Use of filters other than ChipBLASTER will void warranty coverage for any filtration related damage or failures.**

24.0. WARRANTY (Cont.):

- 24.2.6. Other than the obligations imposed upon ChipBLASTER under this limited warranty, ChipBLASTER shall not be liable for any other costs, expenses or losses that the purchaser incurs to remedy any defect.
- 24.2.7. Repairs of defects in material or workmanship during the limited warranty period shall be performed only by ChipBLASTER approved service technicians; the cost of repairs performed by others will not be reimbursed by ChipBLASTER unless prior approval is received in writing from ChipBLASTER.
- 24.2.8. This limited warranty shall cover alleged defects in materials and workmanship about which ChipBLASTER receives notice within thirty (30) days of either the discovery of the alleged defect or the expiration of the limited warranty period, whichever is earlier. Any claim not made within this time shall be conclusively deemed to have been waived by the purchaser.
- 24.2.9. Failure of the purchaser to maintain the equipment by completing all of the scheduled maintenance tasks set forth in Exhibit A to this limited warranty entitled "ChipBLASTER Maintenance Schedule" will void this limited warranty, and release ChipBLASTER from any liability hereunder. **ChipBLASTER may require purchaser to provide evidence of timely completion of the scheduled maintenance tasks set forth in Exhibit A.**
- 24.2.10. ChipBLASTER warranty card must be completed by purchaser and returned to ChipBLASTER within 30 days after installation of ChipBLASTER equipment to validate this limited warranty.

Procedures for Obtaining Technical Service or Warranty Service. Repair or replacement under this limited warranty can only be obtained by registering a warranty claim directly with ChipBLASTER. To enable ChipBLASTER to respond to a request for technical assistance or a request for warranty service, the purchaser must provide, at a minimum, the following information during the initial telephone call: model number, serial number and information regarding any optional ChipBLASTER™ components; the date of purchase; the dealer or supplier from whom the equipment was purchased; the nature of the problem or difficulty. A warranty claim form can be obtained by contacting ChipBLASTER at 800-241-3163.

Limitation of Liability. ChipBLASTER's liability under this warranty is limited as set forth herein. This limited warranty and the remedies set forth herein constitute the sole and exclusive remedy available to the purchaser of ChipBLASTER™ equipment covered by this limited warranty, and are in lieu of any or all other remedies, whether based on statements or promises which are oral, written, express or implied, and whether in contract, tort, equity or otherwise.

ChipBLASTER neither extends nor provides any warranty, expressed or implied, on any products not manufactured by or sold by ChipBLASTER. Problems caused to ChipBLASTER™ equipment or other equipment by products used in conjunction with ChipBLASTER™ equipment which are not either manufactured by ChipBLASTER or manufactured to design specifications provided by ChipBLASTER and specifically approved by ChipBLASTER in writing are not the responsibility of ChipBLASTER, either under this warranty, or otherwise.

This warranty excludes all implied warranties of merchantability or fitness for particular purpose or any purpose.

This warranty specifically excludes reimbursement or liability for "downtime," loss of income and/or consequential damages.

In no event will ChipBLASTER's liability to the purchaser resulting from any claim or loss arising out of a purchaser's purchase of ChipBLASTER™ equipment or the operation thereof exceed the purchase price of the product manufactured or sold by ChipBLASTER.

24.0. WARRANTY (Cont.):**24.3. WARRANTY (LIMITED) – RETROFITS****ChipBLASTER, Inc. Limited Warranty - High Pressure Retrofits**

Limited Warranty. ChipBLASTER, Inc. warrants its ChipBLASTER™ high-pressure retrofits to be free from defects in materials and workmanship for the lesser of one year or 4160 operating hours from the date of delivery to the original user, subject to the conditions set forth below. During this warranty period, ChipBLASTER will repair or replace, at its sole option, defective products or parts without charge to the purchaser. ChipBLASTER, Inc. further warrants that its ChipBLASTER™ high-pressure retrofit systems will not adversely affect or damage the cutting equipment on which ChipBLASTER installs such systems.

Limited Warranty Conditions:

- 24.3.1. Warranty applies only to new ChipBLASTER retrofits.
- 24.3.2. This limited warranty does not apply to any damage, failure, defect or loss caused by any or all the following circumstances or conditions: failure to follow instructions or observe cautions and warnings relating to installation, operation, applications, inspection and regular³ maintenance, as specified in any ChipBLASTER manual, quotation, acknowledgment, sales literature, spec sheet or installation instructions (all of which shall hereinafter be referred to as “applicable literature”); use of ChipBLASTER retrofits outside the parameters of “normal usage” including, but not limited to misapplication, misuse, failure to follow directions and instructions provided by ChipBLASTER applicable literature; any damage or loss to products or parts which results from the alteration, repair, modification, faulty installation, or service (other than regular maintenance) by any one other than an authorized ChipBLASTER service technician and the use of any add-ons, parts, accessories or components not obtained from ChipBLASTER or an authorized ChipBLASTER supplier or approved in writing by ChipBLASTER; damage to products or parts caused by accident, abuse or misuse; normal wear and tear; damage which occurs in shipment or as a result of an act of God, such as lightening, or electrical failures such as line surges or brownouts.
- 24.3.3. Any replacement equipment or parts provided to the purchaser in fulfilling this warranty are warranted for the un-expired portion of the original warranty.
- 24.3.4. If any ChipBLASTER products are found upon ChipBLASTER’s examination in response to a warranty claim to have defects in material or workmanship, ChipBLASTER will either replace or repair the product, at its sole option.
- 24.3.5. Warranty repairs will be completed at the purchaser’s location.
- 24.3.6. Other than the obligations imposed upon ChipBLASTER under this limited warranty, ChipBLASTER shall not be liable for any other costs, expenses or losses that the purchaser incurs to remedy any defect.
- 24.3.7. Repairs of defects in material or workmanship during the limited warranty period shall be performed only by ChipBLASTER approved service technicians; the cost of repairs performed by others will not be reimbursed by ChipBLASTER unless prior approval is received in writing from ChipBLASTER.

³ Regular maintenance includes the minor normal maintenance required to be performed by buyer, at buyer’s expense as set forth in the maintenance schedule included with this warranty as Exhibit A and posted on the outside panel of the ChipBLASTER. **Use of filters other than ChipBLASTER will void warranty coverage for any filtration related damage or failures.**

24.0. WARRANTY (Cont.):

24.3.8. This limited warranty shall cover alleged defects in materials and workmanship about which ChipBLASTER receives notice within thirty (30) days of either the discovery of the alleged defect or the expiration of the limited warranty period, whichever is earlier. Any claim not made within this time shall be conclusively deemed to have been waived by the purchaser.

24.3.9. ChipBLASTER warranty card must be completed by purchaser and returned to ChipBLASTER within 30 days after installation of ChipBLASTER retrofits.

Procedures for Obtaining Technical Service or Warranty Service. Repair or replacement under this limited warranty can only be obtained by registering a warranty claim directly with ChipBLASTER. To enable ChipBLASTER to respond to a request for technical assistance or a request for warranty service, the purchaser must provide, at a minimum, the following information during the initial telephone call: model and serial number of the equipment on which the ChipBLASTER retrofit was installed; information regarding the installed ChipBLASTER retrofit; the date of purchase; the dealer or supplier from whom the equipment was purchased; the nature of the problem or difficulty. A warranty claim form can be obtained by contacting ChipBLASTER at 800-241-3163.

Limitation of Liability. ChipBLASTER's liability under this warranty is limited as set forth herein. This limited warranty and the remedies set forth herein constitute the sole and exclusive remedy available to the purchaser of ChipBLASTER™ retrofits covered by this limited warranty, and are in lieu of any or all other remedies, whether based on statements or promises which are oral, written, express or implied, and whether in contract, tort, equity or otherwise.

ChipBLASTER neither extends nor provides any warranty, expressed or implied, on any products not manufactured by or sold by ChipBLASTER. Problems caused to ChipBLASTER™ retrofits used in conjunction with ChipBLASTER™ equipment which are not either manufactured by ChipBLASTER or manufactured to design specifications provided by ChipBLASTER and specifically approved by ChipBLASTER in writing are not the responsibility of ChipBLASTER, either under this warranty, or otherwise.

This warranty excludes all implied warranties of merchantability or fitness for particular purpose or any purpose.

This warranty specifically excludes liability of ChipBLASTER for, "downtime," loss of income and/or consequential damages.

In no event will ChipBLASTER's liability to the purchaser resulting from any claim or loss arising out of a purchaser's purchase of ChipBLASTER™ retrofits or the operation thereof exceed the purchase price of the product manufactured or sold by ChipBLASTER.

24.0. WARRANTY (Cont.):

24.4.WARRANTY CLAIM FORM:

WARRANTY CLAIM FORM

Unit Serial # _____

Unit Description _____

Purchased From _____

Invoice # _____

Invoice Date _____

Installation Date _____

Nature of Problem (including date of occurrence)

24.0. WARRANTY (Cont.):**24.5. WARRANTY REGISTRATION CARD:**

Detach this part of the sheet and mail to ChipBLASTER to activate your warranty. This form MUST be filled out completely to be a valid warranty registration.

WARRANTY REGISTRATION CARD

Unit Serial # _____	Company Name: _____
Unit Description _____	Address: _____
Purchased From _____	City: _____
Invoice # _____	State, Zip Code: _____
Invoice Date _____	Contact Person: _____
Installation Date _____	E-mail Address: _____
Please mail to: ChipBLASTER 13605 South Mosiertown Road Meadville, Pennsylvania 16335	Phone: _____ Fax: _____

Or fax to (814) 724-6287 Attention Service Department

24.0. WARRANTY (Cont.):**24.6. WARRANTY VALIDATION CARD:**

WARRANTY VALIDATION CARD		UNIT SERIAL # _____
Unit Description _____		
Installation Date _____	Purchased From _____	
Invoice # _____	Invoice Date _____	
I _____ on _____ hereby declare the ChipBlaster		
<i>Signature</i> <i>date</i>		
high pressure coolant system has been installed on _____ according		
<i>machine model</i>		
to ChipBlaster procedures (Note: ChipBlaster Standard Warranty will commence with		
the above signed date if all conditions of the procedures are met).		
(Office Use Only)		SEND TO: ChipBLASTER
Date Warranty Registration Received _____		13605 South Mosiertown Road
		Meadville, PA 16335
		Attn: Warranty Dept.

27.0. OPTIONAL EQUIPMENT:

27.1 Magelis Human machine interface Unit (HMI)

- 27.1.1 Used to display in plain English, operating status, and faults.
- 27.1.2 During normal operation the status of the of the coolant system will be displayed on the operator interface unit. The following information will be displayed:
 - 27.1.2.1. Coolant No. 1 ON (Will show filter being used [A or B] when autocross option is being used).
 - 27.1.2.2. Coolant No. 2 ON (Will show filter being used [A or B] when autocross option is being used).
 - 27.1.2.3. Coolant No. 1 and 2 (Will show filter being used [A or B] when autocross option is being used).
 - 27.1.2.4. Index No. 1 ON (Will show filter being used [A or B] when autocross option is being used).
 - 27.1.2.5. Index No. 2 ON (Will show filter being used [A or B] when autocross option is being used).
 - 27.1.2.6. Index No. 1 and 2 ON (Will show filter being used [A or B] when autocross option is being used).
- 27.1.3. Faults that will be displayed are:
 - 27.1.3.1. Filter dirty (single filter system).
 - 27.1.3.2. Filter “A” dirty (autocross system).
 - 27.1.3.3. Filter “B” dirty (autocross system).
 - 27.1.3.4. Post filter dirty.
 - 27.1.3.5. Drive Fault.
 - 27.1.3.6. Slow coolant return.
 - 27.1.3.7. Low pressure lockout (Optional Pressure Switch Required).
 - 27.1.3.8. Low coolant limit.
 - 27.1.3.9 Circuit breaker or Overload trip.
- 27.1.4. Available as part of the operator interface is a provision to view the last eight (8) faults. To view the past eight (8) faults press the **DOWN ARROW** key while the coolant system is stopped and not in a fault condition. The display uses a last in last out sequence that is the last fault that occurred will be the first fault displayed. Each press of the **DOWN ARROW** key will display a fault until the pass eight have been stepped through at which time the display will revert to the start up screen. If there is no fault stored in any of the past eight (8) storage locations a message will indicate “NO FAULT STORED IN LOCATION No. x. At any time the main screen may be recalled by pressing the **ESC** key, stepping through all eight (8) fault storage areas or when a “Call for coolant” is requested.
- 27.1.5. Included also are screens to display the total number of faults and the total time (in minutes) that the coolant system was in a fault condition. To step through these screens press the **RIGHT ARROW** key. Each press will step to the next screen until each has been displayed at which time the display will revert to start up screen. At any time the main screen may be recalled by pressing the **ESC** key, stepping through all eight (8) screens or when a “Call for coolant” is requested. The first screen that will be displayed will be the coolant system total run time. The total run time is displayed in years, hours and minutes.
NOTE: the years displayed is based on shift of operation (2080 hours).

27.0. OPTIONAL EQUIPMENT (Cont.):**27.1. Magelis Human Interface Unit (HMI) (Cont.)**

- 27.1.6. The order of screens are:
 - 27.1.6.1. Machine run time.
 - 27.1.6.2. Circuit breaker or overload trip.
 - 27.1.5.3. Pressure below 300 PSIG (requires optional pressure switch).
 - 27.1.5.4. Tank low limit.
 - 27.1.5.5. Drive fault.
 - 27.1.5.6. Filter “A” dirty.
 - 27.1.5.7. Filter “B” dirty.
 - 27.1.5.8. Post filter dirty.
- 27.1.7. Also included as part of the HMI programming is the “Super Users Group” In this screens it possible to modify certain control parameters. The parameters are:
 - 27.1.7.1. Coolant #1 off delay set point adjustable from 0 to 2.5 seconds (default is 2.5 seconds).
 - 27.1.7.2. Coolant #2 off delay set point adjustable from 0 to 2.5 seconds (default is 2.5 seconds).
 - 27.1.7.3. Skimmer off set point adjustable from 5 to 30 minutes (default is 10 minutes).
 - 27.1.7.4. Skimmer on set point adjustable from 1 to 20 minutes (default is 5 minutes).
 - 27.1.7.5. Slow coolant return delay before warning set point adjustable from 2 to 4 minutes (default is 2 minutes).
 - 27.1.7.6. Low pressure switch enable. This will enable the use of an optional pressure switch to monitor outlet number 1. An alarm will be sounded if the pressure falls below 300 PSIG (20.6 bar).
 - 27.1.7.7. Autocross enable. This will enable automatic change over from filter A to filter B when filter A becomes dirty. This requires factory installed filters, solenoid valves and additional inputs/outputs from the PLC. THIS NOT A RECOMMENDED FIELD MODIFICATION.
 - 27.1.7.8. Run relay enable. This option sets the ChipBLASTER to run continuous with high pressure controlled by the “Call for coolants” only. This option would be used for machine tools that have multiple fast tool changes with short cycle times.
 - 27.1.7.9. Pulsed “M” code enable. This option sets the ChipBLASTER to operate using a pulsed “M” code in lieu of a maintained “M” code. When this option is enabled a “FIN” / “ACH” signal is available as an output to machine tool. Also available is a input to the ChipBLASTER for a machine tool door open switch.
 - 27.1.7.10. Low pressure hose wash down enable. This option allows the use of a “garden” style hose to be used to with low pressure filtered coolant to wash off the mill table or tomb stone during a part change. THIS NOT A RECOMMENDED FIELD MODIFICATION.
 - 27.1.7.11. Low pressure flood coolant enable. This will enable the ChipBLASTER to supply low pressure filtered coolant through coolant number 1 outlet to the machine tool. THIS NOT A RECOMMENDED FIELD MODIFICATION.

27.0. OPTIONAL EQUIPMENT (Cont.):**27.1. Magelis Human Interface Unit (HMI) (Cont.)**

27.1.7.12. To access the “Super Users Group” press the **RIGHT ARROW** key and the **FAULT RESET/PURGE** pushbutton at the same time.

27.1.8. Pass fault memory clear and pass fault counter timer clear.

27.1.8.1. The past fault data may be cleared by pressing the **DOWN ARROW** key and the **FAULT RESET/PURGE** pushbutton at the same time.

NOTE: this will only clear the fault memory not the machine run timer data.

27.1.9. The Magelis HMI may be field installed by cutting the mounting hole in the door of the control enclosure, mounting the HMI, plugging in the communication adapter module to the PLC , plugging in the communications cable into the PLC and the HMI. PLEASE CONTACT ChipBLASTER to order the preprogrammed HMI and associated components.

NOTE: IF THE COOLANT SYSTEM IS STARTED WHILE IN EITHER OF THE PASS FAULT SCREEN OR TOTAL FAULTS SCREEN THE SCREEN BEING DISPLAYED WILL CHANGE TO ONE OF THE RUN STATUS SCREENS DEPENDING ON THE ACTUAL OPERATING CONDITION.

At this time the **LEFT ARROW** and **UP ARROW** keys are not used.

27.0. OPTIONAL EQUIPMENT (Cont.):

27.15. OIL SKIMMER

27.15.1. Oil Skimmer operation:

27.15.1.1. The oil skimmer is designed to remove floating “tramp” oil from the surface of the fluid in the ChipBLASTER tank. The oil skimmer cycles on for 5 minutes and then is off for 10 minutes.



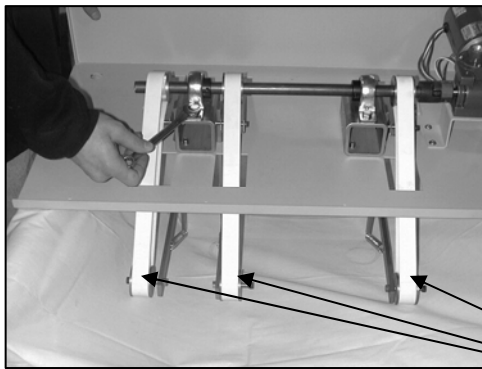
BEFORE STARTING THIS OR ANY MAINTENANCE ON A ChipBLASTER UNIT MAKE SURE ALL POWER IS OFF TO THE UNIT.

27.15.1.2. You will need a 9/16 wrench or socket and ratchet for this job.

27.15.2. To replace worn belts is suggested the oil skimmer unit be removed from the tank.

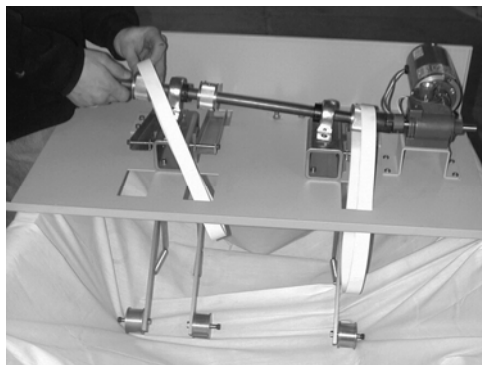
27.15.3. Remove the belts from the lower set of idler wheels that are normally inside the reservoir tank.

27.15.4. Loosen the four 3/8-16 bolts that hold the shaft in place.



Remove belts from idlers first (27.12.3.).

27.15.5. Lift the end of the shaft and remove belts.



27.0. OPTIONAL EQUIPMENT (Cont.):

27 15. OIL SKIMMER (Cont.)

27.15.6. Inspect the wheels and make sure they are clean and still have grooves to grip the belt.

Note: If the wheels on the shaft are smooth they will not grip the belts!

27.15.7. After you inspect the wheels replace the new belts on the shaft.

27.15.8. Put the bolts back in place and tighten the bolts.

27.15.9. Place the belts back on the wheels in the reservoir tank.

27.15.10. Re-install the oil skimmer unit back on tank.

27.15.11. Plug oil skimmer in and turn power on and inspect when the oil skimmer turns on.

27.15.12. Close lid and install locking fastener.



DO NOT OPERATE OIL SKIMMER OUTSIDE TANK.



**REPLACE ALL PANELS (GUARDS) BEFORE RETURNING THE
ChipBLASTER TO PRODUCTION STATUS.**

27.0. OPTIONAL EQUIPMENT (Cont.):**27.17. Magnetic separator:**

The magnetic separator consists of a high strength collector that will remove 90% of all ferrous particles over 25 microns. The filthy coolant associated with materials like cast iron is not a problem when a magnetic separator is utilized.

27.17.1. Magnetic separator requires no maintenance other than to check roller periodically for any build up.



27.0. OPTIONAL EQUIPMENT (Cont.):

27.18. HYDROCYLONIC FILTER INSERT:

This option mechanically separates the heavy particles out of the coolant and forces the particles to the bottom of the filter canister to increase the overall filter life.



SAFETY GLASSES AND GLOVES MUST BE WORN WHEN CHANGING FILTER.



USE EXTREME CARE WHEN REMOVING FILTER BAGS AS THEY WILL BE HEAVY.



REFER TO SECTION 14.5 FOR FILTER CHANGING PROCEDURE.


27.0. OPTIONAL EQUIPMENT (Cont.):**27.19. PRESET PRESSURES:**

27.19.1. Preset pressures add the flexibility of four pre programmed drive speeds to give four separate operating pressures by the use of “M” codes from the machine tool. The machine tool control must be capable of a total of 4 sets of maintained (on and off) “M” codes total for a single outlet ChipBLASTER or 5 sets of maintained (on and off) for a two outlet ChipBLASTER. The machine tool must also be capable of supplying two maintained “M” codes at the same time for pressures of 750, 500 and 250 to 300 psig. The call for coolant “M” code used to energize CR1 and/or CR2 (if used) alone will be used for pressure number 1 typically 1000 PSIG (68.9 Bar). The call for coolant “M” code used to energize CR1 and/or CR2 (if used) and CR21 will be used for pressure number 2 typically 750 PSIG (51.7 Bar). The call for coolant “M” code used to energize CR1 and/or CR2 (if used) and CR22 will be used for pressure number 3 typically 500 PSIG (34.4 Bar). The call for coolant “M” code used to energize CR1 and/or CR2 (if used) and CR23 will be used for pressure number 4 typically between 250 and 300 PSIG (17.2 and 20.6 Bar). Refer to figure 21 for chart.

NOTE: OTHER PRESSURE SETTINGS ARE AVAILABLE BETWEEN THE MINIMUM AND MAXIMUM RANGE OF THE ChipBLASTER UNIT. FOR OTHER SETTING PLEASE ADVISE ChipBLASTER Inc. AT THE TIME OF ORDER.

IT IS RECOMMENDED THAT PRESET PRESSURES BE PURCHASED AT THE SAME TIME THE ChipBLASTER UNIT IS PURCHASED.

Figure 21.

	CR 1 AND/OR CR2	CR 21	CR22	CR23	PRESSURE PSIG	
SPEED #1	1	0	0	0	1000	FASTEST
SPEED #2	1	1	0	0	750	
SPEED #3	1	0	1	0	500	
SPEED #4	1	0	0	1	250 - 300	SLOWEST

A "1" INDICATES WHICH RELAY IS ENERGIZED.

IF MAINTAINED “M” CODES ARE NOT AVAILABLE PLEASE CONTACT ChipBLASTER SALES FOR AN INTERFACE TO CONVERT PULSED OR MOMENTARY “M” CODES TO MAINTAINED. PLEASE PROVIDE THE FOLLOWING INFORMATION:

27.19.2. Voltage of signal i.e. 24 VDC or 110 VAC.

27.19.3. Is acknowledgement “ACK” or finish “FIN” signal is required by machine tool.

27.19.4. Will one “M” code turn on each of the call for coolant and / or pressure requests and then use one “M” code to shut all “M” codes off.

27.19.5. Also any special considerations that may be required.

**DO NOT EXCEED THE MACHINE TOOL MANUFACTURERS
MAXIMUM OPERATING PRESSURE.**



27.0. OPTIONAL EQUIPMENT (Cont.):**27.20. OPTIONAL WASH DOWN:**

- 27.20.1. The optional wash down feature is designed to allow the machine tool operator to utilize low pressure filtered coolant to wash off fixtures, vises and parts as required for a timed period.
- 27.20.2. In order to use this feature the “M” codes to call for a coolant must be off and the high pressure pump must be off.
- 27.20.3. To use the wash down feature, the operator must press the wash down start push button located on the ChipBLASTER electrical enclosure. The filter pump will operate and low pressure coolant will be available at the nozzle of the wash down hose for two (2) minutes.
- 27.20.4. The low pressure wash down may be stopped by pressing the wash down start push button, energizing a call for coolant or allowing the timer to time out.
- 27.20.5. During the low pressure wash down the bag filter(s) are still monitored. If a bag filter in a single filter system becomes dirty the low pressure wash down coolant will shut off. If the bag filter in an auto cross becomes dirty the system will change from filter “A” to filter “B” (if “A” filter is operating). If the system is running on “B” filter than the low pressure wash down coolant will shut off. The filter dirty light will flash to indicate a dirty filter. Refer to SECTION 14.5. for filter changing procedure.



WASH DOWN
START / STOP
PUSH BUTTON



27.19

WASH DOWN HOSE

27.0. OPTIONAL EQUIPMENT (Cont.):

27.21. OPTIONAL DROP IN CHILLER:

TURMOIL

WEST SWANZEY, NH 03469
603-352-0053

INSTALLATION, MAINTENANCE and OPERATION MANUAL

MODEL OC - 75 DI CTC/ATC

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27.0. OPTIONAL EQUIPMENT (Cont.):**27.21. OPTIONAL DROP IN CHILLER (Cont.):**

WARNING

DO NOT ATTEMPT TO START UP THIS COOLER UNTIL YOU HAVE READ THROUGH THE INSTRUCTIONS COMPLETELY. IMPROPER START-UP WILL VOID THE COOLER WARRANTY AND DAMAGE THE MACHINE.

27.21.1. UNCRATING & INSPECTION

- 27.21.1.1. Rough handling during shipment may cause obvious and / or concealed damage. Upon arrival, the cooler should be inspected carefully and claims for damage must be filed immediately with the trucker.
- 27.21.1.2. When uncrating the cooler, inspect it thoroughly for signs of concealed damage. Coolers that have been dropped or shipped on their side may not show external damage. If damages are found, a claim must be filed with the carrier within thirty days of delivery.

27.21.2. COOLER PLACEMENT

- 27.21.2.1. The cooler is designed to be mounted on top of a tank with the stainless steel evaporator coils fully immersed. Tank liquid level should be maintained within 8" of the top of the tank. Lower liquid level will reduce the cooling capacity or damage the compressor. The cooler should never be operated without the stainless steel evaporator coils completely immersed in liquid.
- 27.21.2.2. The cooler is provided with an air intake filter that must be kept clean. The cooler will draw air in through the air filter on the front panel and exhale air through the top. It is imperative that these vents remain open to permit the free movement of air. Lack of adequate cool air will cause a reduction in cooling capacity and/or completely shutdown the refrigeration compressor.
(Two feet of open space on air intake and discharge).
- 27.21.2.3. The cooler is provided with two lifting eyebolts. Use these two eyebolts to lift the cooler and place it in position on the sump tank. The cooler cabinet should be securely fastened to the sump top.

27.21.3. ELECTRICAL HOOK-UP

- 27.21.3.1. See Electrical diagram attached. The cooler is wired for 230 Volt /60 Hertz /1 Phase. Check name plate to verify the proper voltage, hertz and phase. The supply voltage must be within 10% of the rated voltage on the tag. Make ground connection to the grounding screw provided. Check for loose wires. The power connection should be made to the terminals tagged L1 and L2 on the terminal strip in the junction box on the right side panel.
- 27.21.3.2. Terminals #10 and #11 are wired to a HIGH TEMPERATURE interlock switch. This switch opens when coolant temperature exceeds a high temperature setting (See attached temperature controller instructions on adjusting this setting).

27.0. OPTIONAL EQUIPMENT (Cont.):**27.21. OPTIONAL DROP IN CHILLER (Cont.):****27.21.4. TEMPERATURE CONTROLLER**

- 27.21.4.1. This unit is supplied with a digital temperature controller mounted on the front panel. See the attached instruction sheet for operating this controller. A selector switch on the front panel tagged ATC/CTC sets the controller to respond as an Ambient Tracking Controller (ATC) or as Set-point Temperature Controller (CTC).
- 27.21.4.2. The ATC setting works to maintain the coolant at a adjustable temperature differential relative to a fluctuating ambient temperature. The AIR (ambient) sensor is mounted under the temperature controller on the front panel. The coolant sensor is mounted in a dry well close to the evaporator coils. The controller will alternate flashing the ambient temperature and the coolant temperature.
- 27.21.4.3. The CTC setting works to maintain the coolant temperature within 0.5° F of the adjustable set-point. The controller will alternate flashing the set point temperature (S) and the actual temperature (F)

27.21.5. START - UP

- 27.21.5.1. Once the cooler has been installed and the proper electrical connections have been made, it can be started by pressing the ON/OFF switch on the front panel to the ON position. When the switch is pressed to the ON position, an internal green light will energize and the compressor and fan will start if the controller is calling for cooling (after a one minute delay). Do not operate the cooler if the evaporator coils are not completely submersed in coolant.

27.21.6. OPERATION

- 27.21.6.1. When the ON/OFF switch is pressed to the ON position, an internal green light will energize and the compressor and fan will start if the controller is calling for cooling (after a one minute delay). Set the controller to the desired temperature.
- 27.21.6.2. When the controller calls for cooling, the compressor and condenser fan come on after a one minute delay. Refrigerant is pumped by the compressor through the expansion valve to absorb heat as it evaporates in the evaporator/heat exchanger. When the controller calls for heating, the compressor and fan shut down. The cooler should now be ready for continuous operation.

27.21.7. SAFETY INTERLOCKS**27.21.7.1. HIGH TEMPERATURE INTERLOCK**

- 27.21.7.1.1. This cooler has a HIGH TEMPERATURE interlock warning built into the temperature controller. See ATC/CTC controller instructions attached. If the coolant temperature exceeds the high temperature setting the cooler will continue to run but contacts across terminals #10 and #11 will open.

27.21.8. MAINTENANCE

- 27.21.8.1. Every Turmoil cooler is carefully assembled from the finest components by skilled craftsmen. Each cooler is thoroughly tested and inspected before it leaves the factory. However, in order to obtain efficient service and long life from this cooler, it must be given proper care as with any other piece of mechanical equipment

27.0. OPTIONAL EQUIPMENT (Cont.):**27.21. OPTIONAL DROP IN CHILLER (Cont.):**

27.21.8.2. AIR FILTER: Keep Clean

27.21.8.3. CONDENSER: Condenser fins should be cleaned of dust and dirt regularly.

27.21.8.4. PUMP: See attached pump instructions.

27.21.9. TROUBLE SHOOTING

PROBLEM	CAUSE	SOLUTION
Cooler operative but not cooling	A. Low Coolant Level B. Dirty Air Filter C. Blocked Air Flow D. Condenser Clogged E. Faulty Controller F. Low Refrigerant Charge G. Faulty Compressor H. Faulty Solenoid Valve/Coil I. Incorrect Expansion Valve setting	Add Coolant Clean Remove Blockage Clean Repair/Replace Repair * Repair/Replace * Replace * Adjust Expansion Valve to proper setting *
Cooler inoperative or does not start	A. Faulty Power Source B. Cooler OFF on Low Pressure	Check & Correct Check for: Low Coolant Level No Coolant Flow across the coils Low Ambient Wrong Setting on Pressure Switch Low or Lost Refrigerant Charge * Incorrect Expansion Valve Setting *

- Actions designated with * should only be done by a ***Qualified Refrigeration Service Person***. check with factory for proper settings.

27.0. OPTIONAL EQUIPMENT (Cont.):**27.21. OPTIONAL DROP IN CHILLER (Cont.):****27.21.10. PARTS LIST**

SYMBOL	DESCRIPTION	MANUFACTURE	MODEL	PART NUMBERS
FLTR	AIR FILTER	SMITH		
COMP	COMPRESSOR	ASPERA	T6217J	11042
REC	RECEIVER	REF FES	9011	18003
COND	CONDENSER	TECUMSEH	50798-2	13041
FB	FAN BLADE	TECUMSEH	51556	13062
2MTR	MOTOR, FAN	GE	50W	13431
DRY	REFRIGERANT DRIER	PARKER	MMS-200	17202
EYE	REFRIGERANT SIGHT GLASS	DANFOSS	SGN10S	17003
TEV	EXPANSION VALVE	ALCO	ACP-3	14011
CTC	TEMPERATURE CONTROLLER	THERMOLOGIC	CTC - 09	60209
AS	TEMPERATURE SENSOR, AIR	THERMOLOGIC	1122-136	60411
OS	TEMPERATURE SENSOR, OIL	THERMOLOGIC	1122-136	60411
SW1	SWITCH, ON/OFF	ETA	8A	21658
SW2	SWITCH, CTC/ATC	S & S	D5P - AS2	24300

27.0. OPTIONAL EQUIPMENT (Cont.):**27.21. OPTIONAL DROP IN CHILLER (Cont.):****27.21.11. ATC/CTC TEMPERATURE CONTROLLER SETUP**

Oil and Coolant Coolers
West Swanzey, NH 03469
603-352-0053

ATC/CTC TEMPERATURE CONTROLLER

MODEL: DIN FJ370D-N-N-09
RANGE: 20 to 50 degrees C or 68 to 122 degrees F
LINE INPUT VOLTAGE: 120, 208, 240 VAC, +/-10%
SENSOR: Thermistor, 2252 ohms @ 25 degrees C
OUTPUT: Relay K1; 15 amps max. Energizes when the sensor temperature exceeds the set-point temperature.
Relay K2; 15 amps max. Energizes when the sensor temperature exceeds the second set-point temperature.

GENERAL INTRODUCTION:

This is a Set-point (CTC) or Ambient Tracking (ATC), cooling logic control with an auxiliary limit relay. In the Set-point Mode, the Control Output Relay (K1) operates at the Set-point and the Limit Output Relay (K2) operates at the Set-point plus an adjustable Limit Delta-T.

In the Ambient Tracking Mode, the Control Output Relay (K1) operates at the ambient temperature plus an adjustable Set-point Delta-T and the Limit Output Relay (K2) operates at the ambient temperature plus both Set-point Delta-T and Limit Delta-T.

The mode of operation is selected by turning the CTC/ATC selector switch to the desired mode. This switch opens or closes a jumper on J3 of the jumper block approximately in the middle of the control box.

The required jumper position is :

- 1) SET-POINT (CTC) MODE ----- J3 OFF
- 2) AMBIENT TRACKING MODE (ATC)----- J3 ON

The control can be set by jumper J4 to read out in Degrees F or C. Jumper OFF is F and jumper ON is C.

27.0. OPTIONAL EQUIPMENT (Cont.):**27.21. OPTIONAL DROP IN CHILLER (Cont.):****27.21.11. ATC/CTC TEMPERATURE CONTROLLER SETUP (Cont.)**

Process temperature is read by the sensor connected to sensor input #1 (TR5 & TR6). The control set-point (in tracking mode) is established by the temperature sensed on sensor input #2 (TR7 & TR8).

The control relay (K1) is on terminal positions TR9 and TR10. TR9 closes to TR10 when energized.

The limit relay (K2) is on terminal positions TR3 and TR4. TR3 closes to TR4 when energized.

SET-POINT (CTC) MODE:

The display scrolls between Process Temperature (Sensor #1) and Adjusted Set-point approximately every 5 seconds. LED #1 is illuminated when reading Sensor #1. LED #2 is illuminated when reading Set-point. The rightmost character will indicate F to show readout in degrees Fahrenheit (or C for degrees Centigrade if jumper J4 is ON).

The Control Relay K1 will energize when the sensor #1 temperature exceeds set-point. The Limit Relay K2 will energize when the sensor #1 temperature exceeds set-point plus the programmed Limit Delta-T value.

de-energized and the display will read EEE if sensor #1 is open or short circuited.

AMBIENT TRACKING (ATC) MODE:

The display scrolls between Process Temperature (Sensor #1) and Ambient Temperature (Sensor #2) approximately every 5 seconds. LED #1 is illuminated when reading Sensor #1. LED #2 is illuminated when reading Sensor #2. The rightmost character will indicate F to show readout in degrees Fahrenheit (or C for degrees Centigrade if jumper J4 is ON).

The Control Relay K1 will energize when the sensor #1 temperature exceeds ambient temperature plus the programmed Set-point Delta-T value. The Limit Relay K2 will energize when the sensor #1 temperature exceeds ambient temperature plus both the set-point Delta-T value and the Limit Delta-T value.

de-energized and the display will read EEE if Sensor #1 or Sensor #2 is open or short circuited.

PROGRAMMING

To enter the LIMIT DELTA-T programming mode, push SET once. The '*' and '1' LED indicators will light and the control will read LIMIT DELTA-T. Pushing the UP or DOWN arrows will adjust the LIMIT DELTA-T between the limits of 1 and 20 degrees F (1 and 11 degrees C.).

In the SET-POINT MODE (only), pushing SET again will enter the SET-POINT programming mode. The '*' and '2' LED indicators will light and the control will read SET-POINT. Pushing the UP or DOWN arrows will adjust the SET-POINT between the limits of 68 and 122 degrees F (20 and 50 degrees C.).

Pushing SET again will return to the display and control mode.

In the AMBIENT TRACKING MODE (only), simultaneously pushing both the UP and DOWN arrows will enter the SET-POINT DELTA-T programming mode. The '*' LED indicator will light and the control will read SET-POINT DELTA-T. Pushing the UP or DOWN arrows will adjust the SET-POINT DELTA-T between the limits of -20 and +20 degrees F (-11 and +11 degrees C.).

Pushing SET again will return to the display and control mode. If, when in the program mode, no button is pushed for (approximately) 8 seconds, the control will automatically return to display and control.

After programming, the new values are automatically saved in non-volatile memory.

27.0. OPTIONAL EQUIPMENT (Cont.):




27.21. OPTIONAL DROP IN CHILLER (Cont.):

27.21.11. ATC/CTC TEMPERATURE CONTROLLER SETUP (Cont.)

PIN#	DESCRIPTION
1	AC VOLTAGE (HOT)
2	AC VOLTAGE (COMMON)
3	K2 CLOSES "ON RISE"
4	K2 LIMIT ARM
5	SENSOR #1, THERMISTOR 2252 OHMS @ 25°C FLUID
6	SENSOR #1, THERMISTOR 2252 OHMS @ 25°C FLUID
7	SENSOR #2 AMBIENT THERMISTOR 2252 OHMS @ 25°C
8	SENSOR #2 AMBIENT THERMISTOR 2252 OHMS @ 25°C
9	K1 CONTROL ARM
10	K1 CONTROL CLOSING "ON RISE"

LINE VOLTAGE SELECTION: J0

MOVE JUMPER
BLOCK TO POSITION
SHOWN BELOW:

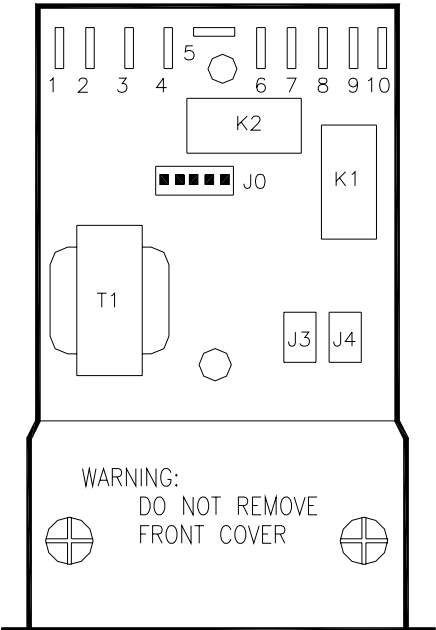
1.  120 VAC
2.  208 VAC
3.  240 VAC

MODE DESIGNATION: J3

OFF = SET-POINT MODE
ON = AMBIENT TRACKING
MODE

TEMPERATURE DESIGNATION: J4

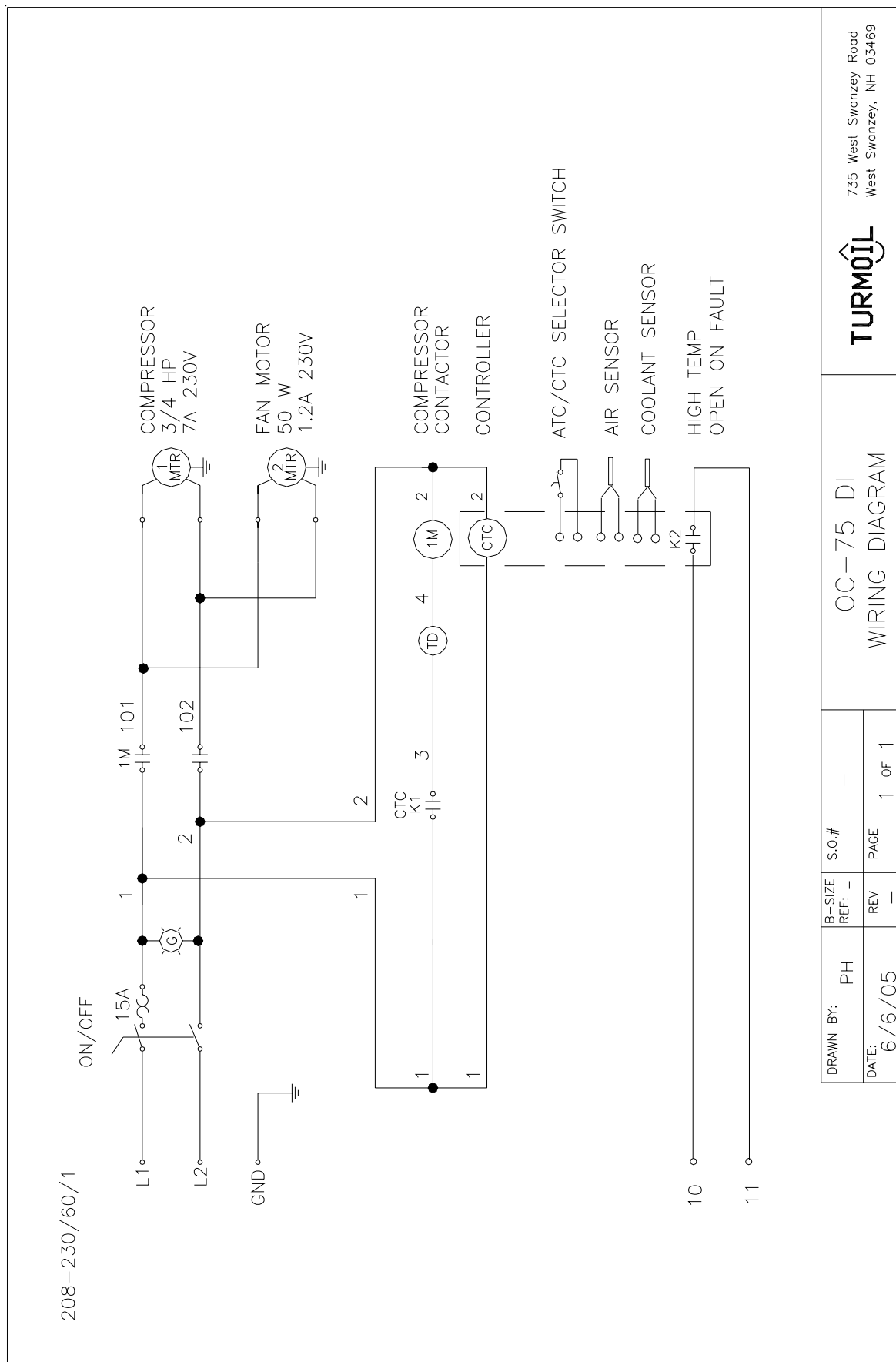
OFF = °F
ON = °C



REFER TO OPERATING INSTRUCTIONS

MODEL NO. — DIN FJ370D-N-N-09
RANGE — 68 TO 122 °F (20-50 °C)
LINE VOLTAGE — 120/208/240 VAC

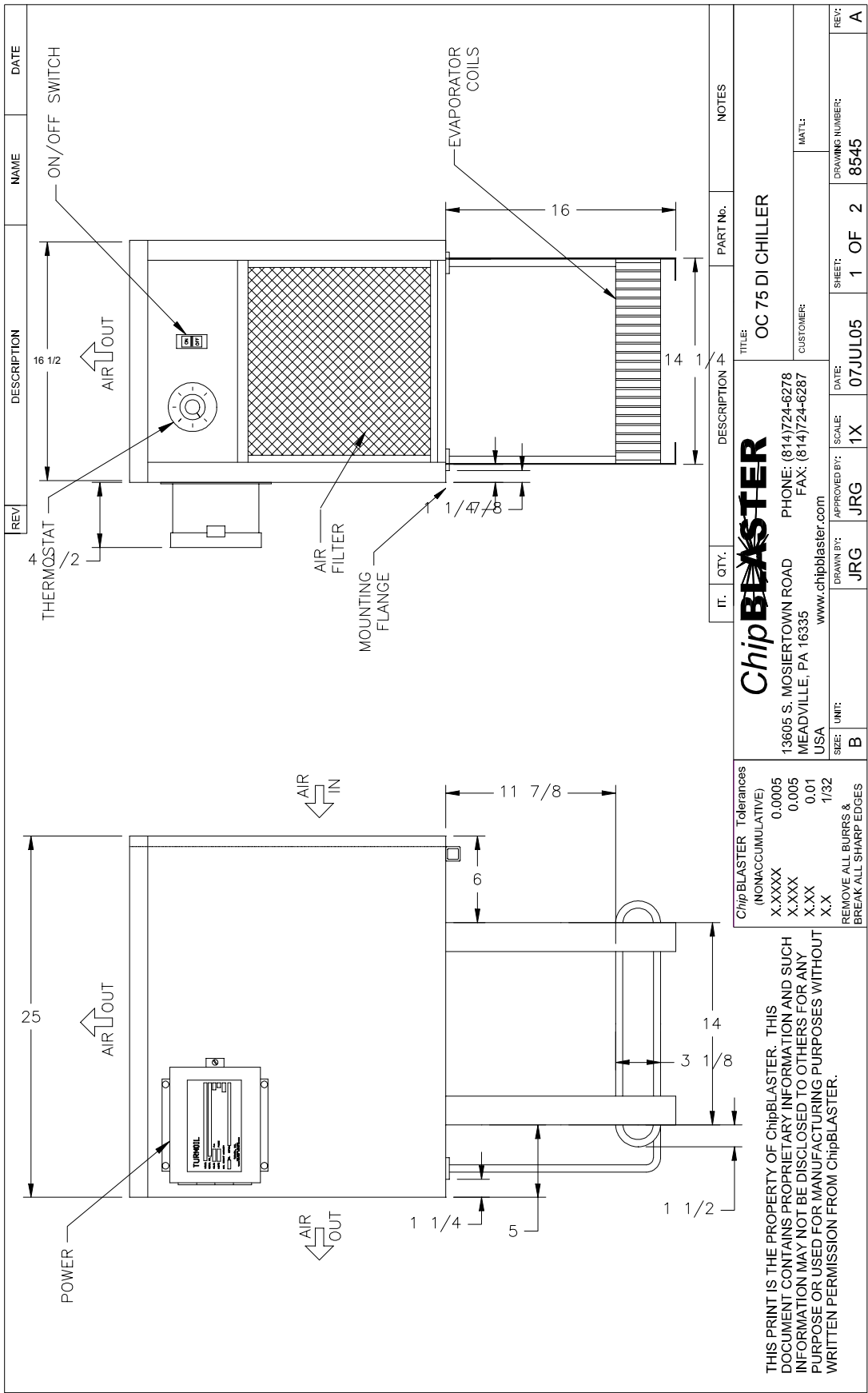
			DUAL TEMPERATURE CONTROLLER ATC/CTC-09		<div></div> <div>735 West Swanzey Road West Swanzey, NH 03469</div>	
BY: DRM	DATE: 8-6-98	REV -				



27.0. OPTIONAL EQUIPMENT (Cont.):

27.21. OPTIONAL DROP IN CHILLER (Cont.):

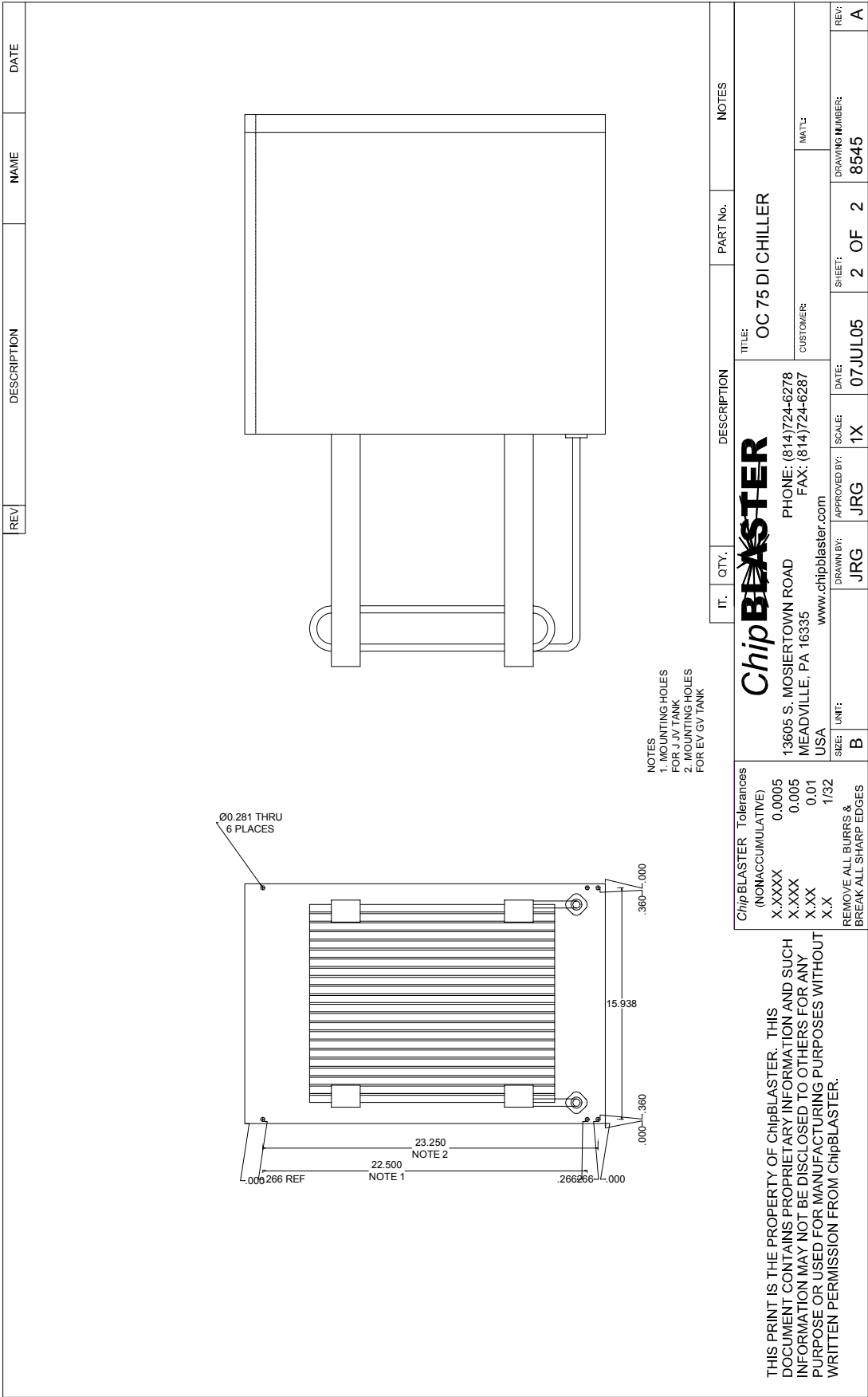
27.21.13. DIMENSIONAL PRINT



27.0. OPTIONAL EQUIPMENT (Cont.):

27.21. OPTIONAL DROP IN CHILLER (Cont.):

27.21.13. DIMENSIONAL PRINT



28.0. SUPPLEMENT DATA:**28.1. PROGRAM REVISION USING EEPROM CHIP:**

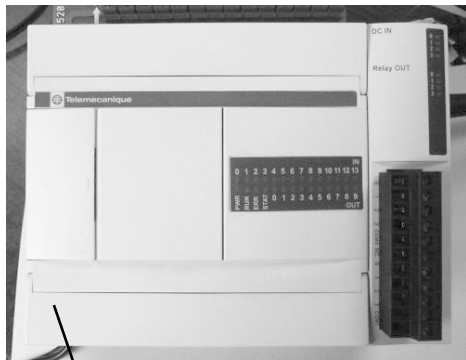
- 28.1.1. The TWIDO PLC has the capabilities of changing programs and restoring programs via a replaceable EEPROM (Electrically Erasable Programmable Read Only Memory) chip. The EEPROM can be inserted only when the PLC is powered down.



DO NOT INSTALL OR REMOVE AN EEPROM CARTRIDGE WHILE THE PLC IS POWERED.

- 28.1.2. Power down the PLC by turning off 4CB.
 28.1.3. Lift the cover over the output terminal strip (lower cover).
 28.1.4. Install the EEPROM cartridge. The EEPROM cartridge will come only be installed one way. Push cartridge into place until it is firmly seated.
 28.1.5. Power up the PLC by turning on 4CB.
 28.1.6. The RUN and START green LED along with the ERR red LED will flash.
 28.1.7. When only the RUN LED is flashing, cycle power to the PLC again.
 28.1.8. The RUN LED will flash and then change to solid on.
 28.1.9. The EEPROM cartridge may be left plugged into the PLC or if it is to be removed power down the PLC by turning off 4CB and then removing the EEPROM cartridge and then re-power the PLC by turning on 4CB.
 28.1.10. Close the cover over the output terminal strip.
 28.1.11. After the revised program is loaded check all circuits for proper operation.

EEPROM socket location



EEPROM
socket located
under this cover



Cover open with EEPROM in place



EEPROM
cartridge in
place

28.0. SUPPLEMENT DATA (CONT.):

28.2. Orifice Reference Chart for 1000 PSI						
Orifice Dia.	Outlet Area (Sq. Inches)	PSI	Velocity (Ft./Sec.)	Volume (GPM)	Horsepower Required	Machine maximum outputs
0.010	0.0001	1000	465	0.1	0.1	
0.015	0.0002	1000	465	0.3	0.2	
0.020	0.0003	1000	465	0.5	0.3	
0.025	0.0005	1000	465	0.7	0.5	
0.030	0.0007	1000	465	1.0	0.7	
0.035	0.0010	1000	465	1.4	1.0	
0.040	0.0013	1000	465	1.8	1.2	
0.045	0.0016	1000	465	2.3	1.6	
0.050	0.0020	1000	465	2.8	1.9	
0.055	0.0024	1000	465	3.4	2.4	
Nozzle #XX54	0.0024	1000	465	3.6	2.4	
0.060	0.0028	1000	465	4.1	2.8	
Nozzle #XX55	0.0028	1000	465	4.1	2.8	J4 - 1000
0.065	0.0033	1000	465	4.8	3.3	
0.070	0.0038	1000	465	5.6	3.8	
0.075	0.0044	1000	465	6.4	4.4	
Nozzle #XX56	0.0049	1000	465	7.1	4.9	
0.080	0.0050	1000	465	7.8	5.1	J8 - 1000
0.085	0.0057	1000	465	8.2	5.6	JV8 - 1000
0.090	0.0064	1000	465	9.2	6.3	
Nozzle #XX57	0.0069	1000	465	10.0	6.8	
0.095	0.0071	1000	465	10.3	7.0	
0.100	0.0079	1000	465	11.4	7.8	
0.105	0.0087		465	12.5	8.6	
0.110	0.0095	1000	465	13.8	9.4	EV2000
0.115	0.0104	1000	465	15.0	10.3	
0.120	0.0113	1000	465	16.4	11.2	CV16
0.125	0.0123	1000	465	17.8	12.2	
0.130	0.0133	1000	465	19.2	13.2	
Nozzle #XX58	0.0138	1000	465	20.0	13.7	
0.135	0.0143	1000	465	20.7	14.2	
0.140	0.0154	1000	465	22.3	15.3	
0.145	0.0165	1000	465	23.9	16.4	
0.150	0.0177	1000	465	25.6	17.5	CV26
0.155	0.0189	1000	465	27.3	18.7	
0.160	0.0201	1000	465	29.1	19.9	
0.165	0.0214	1000	465	31.0	21.2	
0.170	0.0227	1000	465	32.9	22.5	
0.175	0.0241	1000	465	34.8	23.9	
0.180	0.0254	1000	465	36.9	25.2	CV36
0.185	0.0269	1000	465	38.9	26.7	
0.190	0.0284	1000	465	41.1	28.1	
0.195	0.0299	1000	465	43.3	29.6	
0.200	0.0314	1000	465	45.5	31.2	
0.205	0.0330	1000	465	47.8	32.7	
0.210	0.0346	1000	465	50.2	34.4	
0.215	0.0363	1000	465	52.6	36.0	
0.220	0.0380	1000	465	55.1	37.7	
0.245	0.0471	1000	465	68.3	46.8	
0.250	0.0491	1000	465	71.1	48.7	
0.255	0.0511	1000	465	74.0	50.7	
0.265	0.0552	1000	465	79.9	54.7	MV-1000

28.0. SUPPLEMENT DATA (CONT.):

28.3. Orifice Reference Chart for 1500 PSI						
Orifice Dia.	Outlet Area (Sq. Inches)	PSI	Velocity (Ft./Sec.)	Volume (GPM)	Horsepower Required	Machine maximum outputs
0.010	0.0001	1500	569	0.1	0.1	
0.015	0.0002	1500	569	0.3	0.3	
0.020	0.0003	1500	569	0.6	0.6	
0.025	0.0005	1500	569	0.9	0.9	
0.030	0.0007	1500	569	1.3	1.3	
0.035	0.0010	1500	569	1.7	1.8	
0.040	0.0013	1500	569	2.2	2.3	
0.045	0.0016	1500	569	2.8	2.9	
0.050	0.0020	1500	569	3.5	3.6	
0.055	0.0024	1500	569	4.2	4.3	
Nozzle #XX54	0.0024	1500	569	4.3	4.4	
0.060	0.0028	1500	569	5.0	5.2	
Nozzle #XX55	0.0028	1500	569	5.0	5.1	
0.065	0.0033	1500	569	5.9	6.0	
0.070	0.0038	1500	569	6.8	7.0	
0.075	0.0044	1500	569	7.8	8.1	
Nozzle #XX56	0.0049	1500	569	8.3	8.7	
0.080	0.0050	1500	569	8.9	9.2	
0.085	0.0057	1500	569	10.1	10.3	EV2000, Vega 2002
0.090	0.0064	1500	569	11.3	11.6	
Nozzle #XX57	0.0069	1500	569	12.2	12.6	
0.095	0.0071	1500	569	12.6	12.9	
0.100	0.0079	1500	569	13.9	14.3	
0.105	0.0087	1500	569	15.4	15.8	
0.110	0.0095	1500	569	16.9	17.3	CV16
0.115	0.0104	1500	569	18.4	18.9	
0.120	0.0113	1500	569	20.1	20.6	
0.125	0.0123	1500	569	21.8	22.4	
0.130	0.0133	1500	569	23.5	24.2	
Nozzle #XX58	0.0138	1500	569	24.5	25.2	
0.135	0.0143	1500	569	25.4	26.1	CV26
0.140	0.0154	1500	569	27.3	28.1	
0.145	0.0165	1500	569	29.3	30.1	
0.150	0.0177	1500	569	31.4	32.2	
0.155	0.0189	1500	569	33.5	34.4	
0.160	0.0201	1500	569	35.7	36.6	
0.165	0.0214	1500	569	37.9	39.0	
0.170	0.0227	1500	569	40.3	41.4	
0.175	0.0241	1500	569	42.7	43.8	
0.180	0.0254	1500	569	45.1	46.4	
0.185	0.0269	1500	569	47.7	49.0	
0.190	0.0284	1500	569	50.3	51.7	
0.195	0.0299	1500	569	53.0	54.4	
0.200	0.0314	1500	569	55.7	57.3	

28.0. SUPPLEMENT DATA (CONT.):

28.4. Orifice Reference Chart for 2000 PSI						
Orifice Dia.	Outlet Area (Sq. Inches)	PSI	Velocity (Ft./Sec.)	Volume (GPM)	Horsepower Required	Machine maximum outputs
0.010	0.0001	2000	657	0.2	0.2	
0.015	0.0002	2000	657	0.4	0.5	
0.020	0.0003	2000	657	0.6	0.9	
0.025	0.0005	2000	657	1.0	1.4	
0.030	0.0007	2000	657	1.4	2.0	
0.035	0.0010	2000	657	2.0	2.7	
0.040	0.0013	2000	657	2.6	3.5	
0.045	0.0016	2000	657	3.3	4.5	
0.050	0.0020	2000	657	4.0	5.5	
0.055	0.0024	2000	657	4.9	6.7	
Nozzle #XX54	0.0024	2000	657	5.0	6.8	
0.060	0.0028	2000	657	5.8	7.9	
Nozzle #XX55	0.0028	2000	657	5.7	7.9	
0.065	0.0033	2000	657	6.8	9.3	
0.070	0.0038	2000	657	7.9	10.8	EV2000, Vega 2002
0.075	0.0044	2000	657	9.1	12.4	
Nozzle #XX56	0.0049	2000	657	10.0	13.7	
0.080	0.0050	2000	657	10.3	14.1	
0.085	0.0057	2000	657	11.6	15.9	
0.090	0.0064	2000	657	13.0	17.9	
Nozzle #XX57	0.0069	2000	657	14.1	19.4	
0.095	0.0071	2000	657	14.5	19.9	
0.100	0.0079	2000	657	16.1	22.0	CV16
0.105	0.0087	2000	657	17.7	24.3	
0.110	0.0095	2000	657	19.5	26.7	
0.115	0.0104	2000	657	21.3	29.1	CV26
0.120	0.0113	2000	657	23.2	31.7	
0.125	0.0123	2000	657	25.1	34.4	
0.130	0.0133	2000	657	27.2	37.2	
Nozzle #XX58	0.0138	2000	657	28.3	38.7	
0.135	0.0143	2000	657	29.3	40.2	
0.140	0.0154	2000	657	31.5	43.2	
0.145	0.0165	2000	657	33.8	46.3	
0.150	0.0177	2000	657	36.2	49.6	
0.155	0.0189	2000	657	38.7	53.0	
0.160	0.0201	2000	657	41.2	56.4	
0.165	0.0214	2000	657	43.8	60.0	
0.170	0.0227	2000	657	46.5	63.7	
0.175	0.0241	2000	657	49.3	67.5	
0.180	0.0254	2000	657	52.1	71.4	
0.185	0.0269	2000	657	55.1	75.4	
0.190	0.0284	2000	657	58.1	79.6	
0.195	0.0299	2000	657	61.2	83.8	
0.200	0.0314	2000	657	64.4	88.2	

28.0. SUPPLEMENT DATA (CONT.):

28.5. Orifice Reference Chart for 2500 PSI						
Orifice Dia.	Outlet Area (Sq. Inches)	PSI	Velocity (Ft./Sec.)	Volume (GPM)	Horsepower Required	Machine maximum outputs
0.010	0.0001	2500	735	0.2	0.3	
0.015	0.0002	2500	735	0.4	0.7	
0.020	0.0003	2500	735	0.7	1.2	
0.025	0.0005	2500	735	1.1	1.9	
0.030	0.0007	2500	735	1.6	2.8	
0.035	0.0010	2500	735	2.2	3.8	
0.040	0.0013	2500	735	2.9	4.9	
0.045	0.0016	2500	735	3.6	6.2	
0.050	0.0020	2500	735	4.5	7.7	
0.055	0.0024	2500	735	5.4	9.3	
Nozzle #XX54	0.0024	2500	735	5.6	9.6	
0.060	0.0028	2500	735	6.5	11.1	
Nozzle #XX55	0.0028	2500	735	6.4	11.0	
0.065	0.0033	2500	735	7.6	13.0	
0.070	0.0038	2500	735	8.8	15.1	
0.075	0.0044	2500	735	10.1	17.3	
Nozzle #XX56	0.0049	2500	735	11.2	19.1	
0.080	0.0050	2500	735	11.5	19.7	
0.085	0.0057	2500	735	13.0	22.3	
0.090	0.0064	2500	735	14.6	24.9	
Nozzle #XX57	0.0069	2500	735	15.8	27.1	
0.095	0.0071	2500	735	16.2	27.8	CV16
0.100	0.0079	2500	735	18.0	30.8	CV26
0.105	0.0087	2500	735	19.8	34.0	
0.110	0.0095	2500	735	21.8	37.3	
0.115	0.0104	2500	735	23.8	40.7	
0.120	0.0113	2500	735	25.9	44.4	
0.125	0.0123	2500	735	28.1	48.1	
0.130	0.0133	2500	735	30.4	52.1	
Nozzle #XX58	0.0138	2500	735	31.6	54.1	
0.135	0.0143	2500	735	32.8	56.1	
0.140	0.0154	2500	735	35.3	60.4	
0.145	0.0165	2500	735	37.8	64.8	
0.150	0.0177	2500	735	40.5	69.3	
0.155	0.0189	2500	735	43.2	74.0	
0.160	0.0201	2500	735	46.1	78.9	
0.165	0.0214	2500	735	49.0	83.9	
0.170	0.0227	2500	735	52.0	89.0	
0.175	0.0241	2500	735	55.1	94.3	
0.180	0.0254	2500	735	58.3	99.8	
0.185	0.0269	2500	735	61.6	105.4	
0.190	0.0284	2500	735	64.9	111.2	
0.195	0.0299	2500	735	68.4	117.1	
0.200	0.0314	2500	735	72.0	123.2	

28.0. SUPPLEMENT DATA (CONT.):

28.6. Orifice Reference Chart for 3000 PSI						
Orifice Dia.	Outlet Area (Sq. Inches)	PSI	Velocity (Ft./Sec.)	Volume (GPM)	Horsepower Required	Machine maximum outputs
0.010	0.0001	3000	805	0.2	0.4	
0.015	0.0002	3000	805	0.4	0.9	
0.020	0.0003	3000	805	0.8	1.6	
0.025	0.0005	3000	805	1.2	2.5	
0.030	0.0007	3000	805	1.8	3.6	
0.035	0.0010	3000	805	2.4	5.0	
0.040	0.0013	3000	805	3.2	6.5	
0.045	0.0016	3000	805	4.0	8.2	
0.050	0.0020	3000	805	4.9	10.1	
0.055	0.0024	3000	805	6.0	12.2	
Nozzle #XX54	0.0024	3000	805	6.1	12.6	
Nozzle #XX55	0.0028	3000	805	7.0	14.4	
0.060	0.0028	3000	805	7.1	14.6	
0.065	0.0033	3000	805	8.3	17.1	
0.070	0.0038	3000	805	9.7	19.8	
0.075	0.0044	3000	805	11.1	22.8	
Nozzle #XX56	0.0049	3000	805	12.2	25.2	
0.080	0.0050	3000	805	12.6	25.9	
0.085	0.0057	3000	805	14.2	29.3	CV26
0.090	0.0064	3000	805	16.0	32.8	CV16
28.7. Orifice Reference Chart for 5000 PSI						
Orifice Dia.	Outlet Area (Sq. Inches)	PSI	Velocity (Ft./Sec.)	Volume (GPM)	Horsepower Required	Machine maximum outputs
0.010	0.0001	5000	1039	0.3	0.9	
0.015	0.0002	5000	1039	0.6	2.0	
0.020	0.0003	5000	1039	1.0	3.5	
0.025	0.0005	5000	1039	1.6	5.4	
0.030	0.0007	5000	1039	2.3	7.8	
0.035	0.0010	5000	1039	3.1	10.7	
0.040	0.0013	5000	1039	4.1	13.9	
0.045	0.0016	5000	1039	5.2	17.6	
0.050	0.0020	5000	1039	6.4	21.8	
0.055	0.0024	5000	1039	7.7	26.4	
Nozzle #XX54	0.0024	5000	1039	7.9	27.1	
0.060	0.0028	5000	1039	9.2	31.4	
Nozzle #XX55	0.0028	5000	1039	9.1	31.1	
0.065	0.0033	5000	1039	10.7	36.8	
0.068	0.0036	5000	1039	11.7	40.0	CV16